REPORT OF
AIR POLLUTION SOURCE TESTING
OF AN ETHYLENE OXIDE EMISSION-CONTROL SYSTEM
OPERATED BY STERIGENICS, INC.
IN ATLANTA, GEORGIA
ON MARCH 17, 2016

Submitted to:

GEORGIA DEPARTMENT OF NATURAL RESOURCES
Environmental Protection Division
4244 International Parkway, Suite 120
Atlanta, Georgia 30354

Submitted by:

STERIGENICS U.S., LLC.
2971 Olympic Industrial Boulevard
Atlanta, Georgia 30339

GDNR Permit Number 7839-067-0093-S-05-3

Prepared by:

ECSI, INC.
PO Box 848
San Clemente, California 92674-0848

April 21, 2016

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CONTACT SUMMARY

CLIENT

Ms. Sue Reinhardt
EHS Manager
STERIGENICS U.S., LLC.
2015 Spring Road, Suite 650
Oak Brook, Illinois 60523

Phone: (630)928-1768
FAX: (630)928-1701
Email: sreinhardt@sterigenics.com

FACILITY

Mr. Daryl Mosby
General Manager
STERIGENICS U.S., LLC.
2973 Olympic Industrial Boulevard
Atlanta, Georgia 30080

Phone: (404)355-4485
FAX: (404)355-4852
Email: dmosby@sterigenics.com

TEST DATE

March 17, 2016

REGULATORY AGENCY

Mr. Don Holder
Principal Environmental Engineer
Stationary Source Compliance Program
GEORGIA DEPARTMENT OF NATURAL RESOURCES
Environmental Protection Division, Air Protection Branch
4244 International Parkway, Suite 120
Atlanta, Georgia 30354

Phone: (404)363-7000
FAX: (404)363-7100
Email: don_holder@dnr.state.ga.us

TESTING CONTRACTOR

Daniel P. Kremer
Project Manager
ECSi, Inc.
PO Box 848
San Clemente, California 92674-0848

Phone: (949)400-9145
FAX: (949)281-2169
email: dankremer@ecsi1.com

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1.0 INTRODUCTION

On Thursday, March 17, 2016, ECSi, Inc. performed air pollution source testing of an ethylene oxide (EtO) emission-control device operated by Sterigenics, Inc. in Atlanta, Georgia. The control device tested was a two-stage Advanced Air Technologies Safe Cell emission-control system, which is currently used to control emissions from ten sterilizer backvents and one aeration room. The purpose of the testing program was to demonstrate continued compliance with the conditions established in the Air Quality Permit granted to Sterigenics by the Georgia Department of Natural Resources, Environmental Protection Division (GDNR).

2.0 EQUIPMENT

The EtO gas-sterilization system is comprised of ten commercial sterilizers, which are discharged through liquid-ring vacuum pumps to a Ceilcote packed tower scrubber emission-control system, ten sterilizer exhaust vents (backvents) and one aeration room, which are discharged to a two-stage Advanced Air Technologies (AAT) Safe Cell emission-control system. As an alternative emission-control scenario, the facility also has the capability to discharge the sterilization chamber vacuum pumps to the AAT Safe Cell system. The gas-sterilization and emission-control equipment consist of the following:

- Ten Gas Sterilizers, two 5-pallet, two 6-pallet, four 13-pallet, and two 30-pallet capacity, each comprised of a steam-heated sterilization chamber, a recirculating vacuum pump chamber evacuation system, a backvent valve, and a fugitive emissions exhaust hood;

- One aeration room (AR-1), 152,400 cubic feet capacity, comprised of a heated aeration chamber and a chamber exhaust system.

Sterilizer vacuum pump emissions are be controlled by:

- One Ceilcote packed tower chemical scrubber, equipped with: a reaction/interface column, 27' 4" high, 42" in diameter, with a 20' bed of #1 Tellerette packing; a 115 GPM scrubber fluid recirculation system; and two 28,000 gallon reaction/storage tanks.

Sterilizer backvent and aeration emissions are controlled by:

- One two-stage Advanced Air Technologies Safe Cell emission-control system, comprised of a packed-tower chemical scrubber (SC1), equipped with a packed reaction/interface column, a scrubber fluid recirculation system, and a scrubber fluid reaction/storage tank, and a dry bed reactor/scrubber (SC2), comprised of a bank of solid-bed reaction vessels, connected in parallel, installed downstream of SC1 and upstream of a dedicated blower exhaust system.

3.0 TESTING

EtO source testing was conducted in accordance with the procedures outlined in USEPA CFR40, Part 63.365. EtO emissions monitoring was conducted simultaneously at the inlet and outlet of the AAT Safe Cell System during the 15-minute duration of the backvent process. A total of three test runs were performed.

During backvent testing, EtO emissions at the inlet and the outlet of the AAT Safe Cell System were determined using direct source sample injection into the gas chromatograph (GC). All backvent testing was performed using freshly sterilized product. The testing program was conducted in accordance with the procedures outlined in the following sections.

4.0 RULE/COMPLIANCE REQUIREMENTS

The EtO gas-sterilization system at Sterigenics was tested to demonstrate compliance with the EPA requirements, as specified in the GDNR Air Quality Permit. The following requirements must be met:

- The emissions from the aeration process must be discharged to control equipment with an EtO emission-reduction efficiency of at least 99.0% by weight.

Testing is required to demonstrate compliance with these requirements. Source testing of the AAT Safe Cell System is required initially, and may be required periodically thereafter.

5.0 TEST METHOD REFERENCE

5.1 INTRODUCTION

EtO source testing was conducted in accordance with the procedures outlined in USEPA CFR40, Part 63.365. EtO emissions monitoring was conducted simultaneously at the inlet and outlet of the AAT Safe Cell System during the 15-minute duration of the backvent process. A total of three test runs were performed.

During backvent testing, EtO emissions at the inlet and the outlet of the AAT Safe Cell System were determined using direct source sample injection into the gas chromatograph (GC). All backvent testing was performed using freshly sterilized product. The testing program was conducted in accordance with the procedures outlined in the following sections.

Operation and documentation of process conditions was performed by personnel from Sterigenics, Inc. using existing monitoring instruments installed by the manufacturer on the equipment to be tested. In accordance with the procedures established in USEPA CFR40, Part 63, Subpart O, scrubber liquor level was recorded. This parametric monitoring data is attached as Appendix G.

5.2 VOLUMETRIC FLOW MEASUREMENT

Exhaust gas flow at the outlet of the scrubber was determined by 40 CFR 60, Appendix A, Method 2, using an s-type pitot tube and an inclined-oil manometer. Sampling ports were located in accordance with 40 CFR 60, Appendix A, Method 1. The test ports were located far enough from any flow disturbances to permit accurate flow measurement.

Temperature measurements were obtained from a type K thermocouple and thermometer attached to the sampling probe. Exhaust gas composition was assumed to be air and small amounts of water vapor. Water vapor was negligible and, based on previous test data, a value of 2 percent was used for flow calculations.

5.3 CONTROL EFFICIENCY AND MASS EMISSIONS MEASUREMENT

During the backvent process, EtO emissions at the inlet and outlet of the AAT Safe Cell System were determined using direct source sample injection into the GC. The mass of EtO emitted from the outlet was determined using Equation 2, shown below in Section 5.9. Mass-mass control-efficiency of EtO during the backvent process was calculated by comparing the mass of EtO vented to the system inlet to the mass of EtO vented from the system outlet.

During backvent, vented gas was analyzed by an SRI, Model 8610, portable gas chromatograph (GC), equipped with the following: dual, heated sample loops and injectors; dual columns; and dual detectors. A flame ionization detector (FID) was used to quantify inlet EtO emissions, and a photoionization detector (PID) was used to quantify low-level EtO emissions at the emission-control system outlet.

5.4 SAMPLE TRANSPORT

Source gas was pumped to the GC at approximately 500-1000 cubic centimeters per minute (cc/min) from the sampling ports through two lengths of Teflon® sample line, each with a nominal volume of approximately 75 cubic centimeters (cc) and an outer diameter of 0.25 inch. At the inlet of the Safe Cell System, the sampling port was located in the plenum immediately upstream packed tower scrubber. At the outlet of the Safe Cell System, sampling ports were located in the exhaust stack downstream of the dry bed reactors.

5.5 GC INJECTION

Source-gas samples were then injected into the GC which was equipped with two heated sampling loops, each containing a volume of approximately 2cc and maintained at 100 degrees Celsius (C). Injections occurred at approximately one to two-minute intervals during backvent testing. Helium was the carrier gas for both the FID and the PID.

5.6 GC CONDITIONS

The packed columns for the GC were both operated at 80 degrees C. The columns were stainless steel, 6 feet long, 0.125 inch outer diameter, packed with 1 percent SP-1000 on 60/80 mesh Carbopack B.

During the analysis, the FID was operated at 250 degrees C. The support gases for the FID were hydrogen (99.995% pure) and air (99.9999% pure). Any unused sample gas was vented from the GC system back to the inlet of the control device being tested.

5.7 CALIBRATION STANDARDS

The FID was calibrated for mid-range part-per-million-by-volume (ppmv) level analysis using gas proportions similar to the following:

1) 100 ppmv EtO, balance nitrogen
2) 50 ppmv EtO, balance nitrogen (audit gas)
3) 10 ppmv EtO, balance nitrogen
4) 1 ppmv EtO, balance nitrogen

The PID was calibrated for low-range ppmv level analyses using gas proportions similar to the following:

1) 100 ppmv EtO, balance nitrogen
2) 50 ppmv EtO, balance nitrogen (audit gas)
3) 10 ppmv EtO, balance nitrogen
4) 1 ppmv EtO, balance nitrogen

Each of these calibration standards was in a separate, certified manufacturer's cylinder. Copies of the calibration gas laboratory certificates are attached as Appendix F.

5.8 SAMPLING DURATION

Backvent testing was performed in conjunction with normal production operations, during the chamber exhaust venting which is conducted for each sterilization chamber upon conclusion of the sterilization cycle, immediately prior to and during chamber unloading. Backvent sampling duration was 15 minutes for each of the three test runs.

5.9 CONTROL-EFFICIENCY/MASS-EMISSIONS CALCULATIONS

Mass emissions of EtO during backvent were calculated using the following equation:

$$MassRate = (VolFlow)(MolWt)(ppmv\ EtO/10^6)/(MolVol)$$

Where:

MassRate	=	EtO mass flow rate, pounds per minute
VolFlow	=	Corrected volumetric flow rate, standard cubic feet per minute at 68 degrees F
MolWt	=	44.05 pounds EtO per pound mole
ppmv EtO	=	EtO concentration, parts per million by volume
10^6	=	Conversion factor, ppmv per "cubic foot per cubic foot"
MolVol	=	385.32 cubic feet per pound mole at one atmosphere and 68 degrees F

Results of the control-efficiency testing are presented in Section 8.0 and in Table 1.

6.0 TEST SCENARIO

The backvent testing was performed during normal process load conditions. Three backvent test runs were conducted in series to verify the performance of the emission-control system. The testing schedule was as follows:

1) Testing equipment was set up and calibrated.
2) Backvent Phase Test Run #1 was conducted with freshly sterilized product in the sterilizer. Sampling was performed at the inlet and the outlet of the Safe Cell System.
3) Backvent Phase Test Run #2 was conducted with freshly sterilized product in the sterilizer. Sampling was performed at the inlet and the outlet of the Safe Cell System.
4) Backvent Phase Test Run #3 was conducted with freshly sterilized product in the sterilizer. Sampling was performed at the inlet and the outlet of the Safe Cell System.
5) Post calibration check was performed, testing equipment was packed.

7.0 QA/QC

7.1 FIELD TESTING QUALITY ASSURANCE

At the beginning of the test, the sampling system was leak checked at a vacuum of 15 inches of mercury. The sampling system was considered leak free when the flow indicated by the rotameters fell to zero.

At the beginning of the test, a system blank was analyzed to ensure that the sampling system was free of EtO. Ambient air was introduced at the end of the heated sampling line and drawn through the sampling system line to the GC for analysis. The resulting chromatogram also provided a background level for non-EtO components (i.e. ambient air, carbon dioxide, water vapor) which are present in the source gas stream due to the ambient dilution air which is drawn into the emission-control device, and due to the destruction of EtO by the emission-control device which produces carbon dioxide and water vapor. This chromatogram, designated AMB, is included with the calibration data in Appendix A.

7.2 CALIBRATION PROCEDURES

The GC system was calibrated at the beginning and conclusion of each day's testing. Using the Peaksimple II analytical software, a point-to-point calibration curve was constructed for each detector. A gas cylinder of similar composition as the calibration gases, but certified by a separate supplier, was used to verify calibration gas composition and GC performance.

All calibration gases and support gases used were of the highest purity and quality available. A copy of the laboratory certification for each calibration gas is attached as Appendix F.

8.0 TEST RESULTS

The AAT Safe Cell System demonstrated an EtO control efficiency of 99.83 percent. In accordance with EPA requirements, as specified in the GDNR Air Quality Permit, this control equipment must have an EtO control efficiency of 99 percent or more in control of emissions from the backvent process. The AAT Safe Cell System met this requirement.

The test results are summarized in Table 1. This table includes results for EtO control efficiency of the emission-control device. Chromatograms and chromatographic supporting data are attached as Appendices A through D. Copies of field data and calculation worksheets are attached as Appendix E.

TABLES

TABLE 1
ETHYLENE OXIDE CONTROL EFFICIENCY - BACKVENT
OF AN ETHYLENE OXIDE EMISSION CONTROL DEVICE
OPERATED BY STERIGENICS, INC.
IN ATLANTA, GEORGIA
ON MARCH 17, 2016

RUN NUMBER	INJECTION TIME	INLET ETO CONC. (PPM)(1)	OUTLET ETO CONC. (PPM)(2)	ETO CONTROL EFFICIENCY
1(3)	2222	252	0.01	99.9960
1	2223	564	3.11	99.4486
1	2225	357	1.81	99.4930
1	2226	266	1.40	99.4737
1	2227	195	0.56	99.7128
1	2229	174	0.43	99.7529
1	2230	154	0.01	99.9935
1	2231	138	0.01	99.9928
1	2233	136	0.01	99.9926
1	2234	127	0.01	99.9921
1	2235	123	0.01	99.9919
2(4)	2254	98.7	0.36	99.6353
2	2255	232	1.14	99.5086
2	2256	203	0.74	99.6355
2	2258	162	0.60	99.6296
2	2259	136	0.64	99.5294
2	2300	94.5	0.01	99.9894
2	2301	86.6	0.01	99.9885
2	2302	77.3	0.01	99.9871
2	2304	68.0	0.13	99.8088
2	2305	68.7	0.01	99.9854
2	2306	63.7	0.01	99.9843
2	2307	62.8	0.01	99.9841
3(5)	2311	400	0.80	99.8000
3	2312	142	0.91	99.3592
3	2314	120	0.12	99.9000
3	2315	112	0.01	99.9911
3	2316	109	0.01	99.9908
3	2317	106	0.01	99.9906
3	2319	103	0.01	99.9903
3	2320	99.8	0.28	99.7194
3	2321	99.8	0.01	99.9900
3	2322	99.3	0.01	99.9899
3	2323	94.9	0.01	99.9895
3	2325	94.4	0.06	99.9364
TIME-WEIGHTED AVERAGE:		**154.8**	**0.3794**	**99.8329**
		GDNR REQUIRED CONTROL EFFICIENCY:		**99%**

Notes:
(1) - PPM = parts per million by volume
(2) - 0.01 ppm is the quantification limit for the detector used at the outlet.
(3) - Backvent Phase Test Run #1 started at 22:20, ended at 22:35.
(4) - Backvent Phase Test Run #2 started at 22:53, ended at 23:08.
(5) - Backvent Phase Test Run #3 started at 23:10, ended at 23:25.

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APPENDICES

APPENDIX A

Calibration Data

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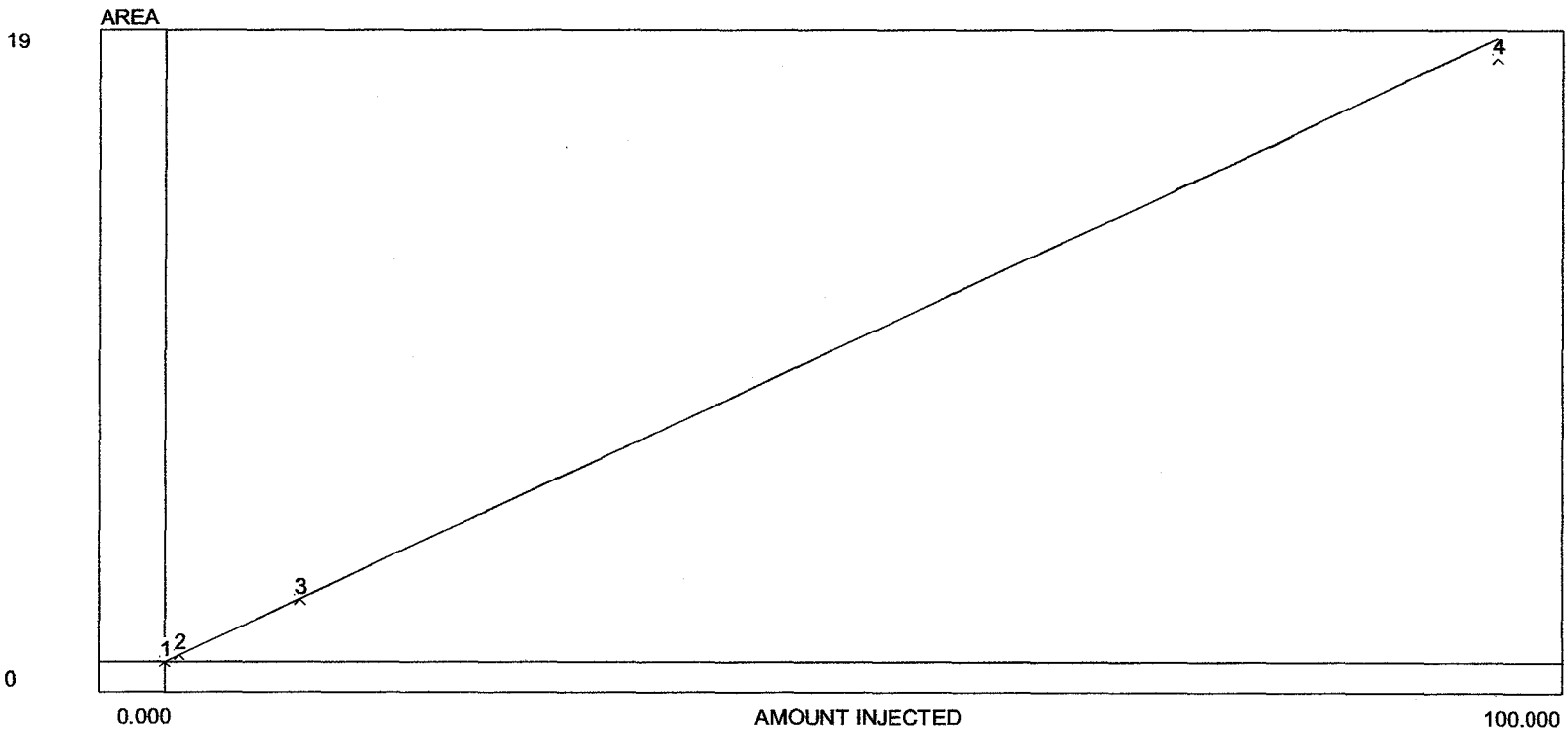
Component file: et01-100.cpt

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Dead Vol / Air	0.000	0.350		0.000	
2	Ambient H2O	0.350	0.500		0.000	
3	Ethylene Oxide	0.500	0.600	C:\peak359\1Ster	0.00016	ppm
4	Acetaldehyde	0.600	0.800		0.000	
5	CO2	0.800	1.000		0.000	

Calibration file: C:\peak359\1SterAtl-2016.cal



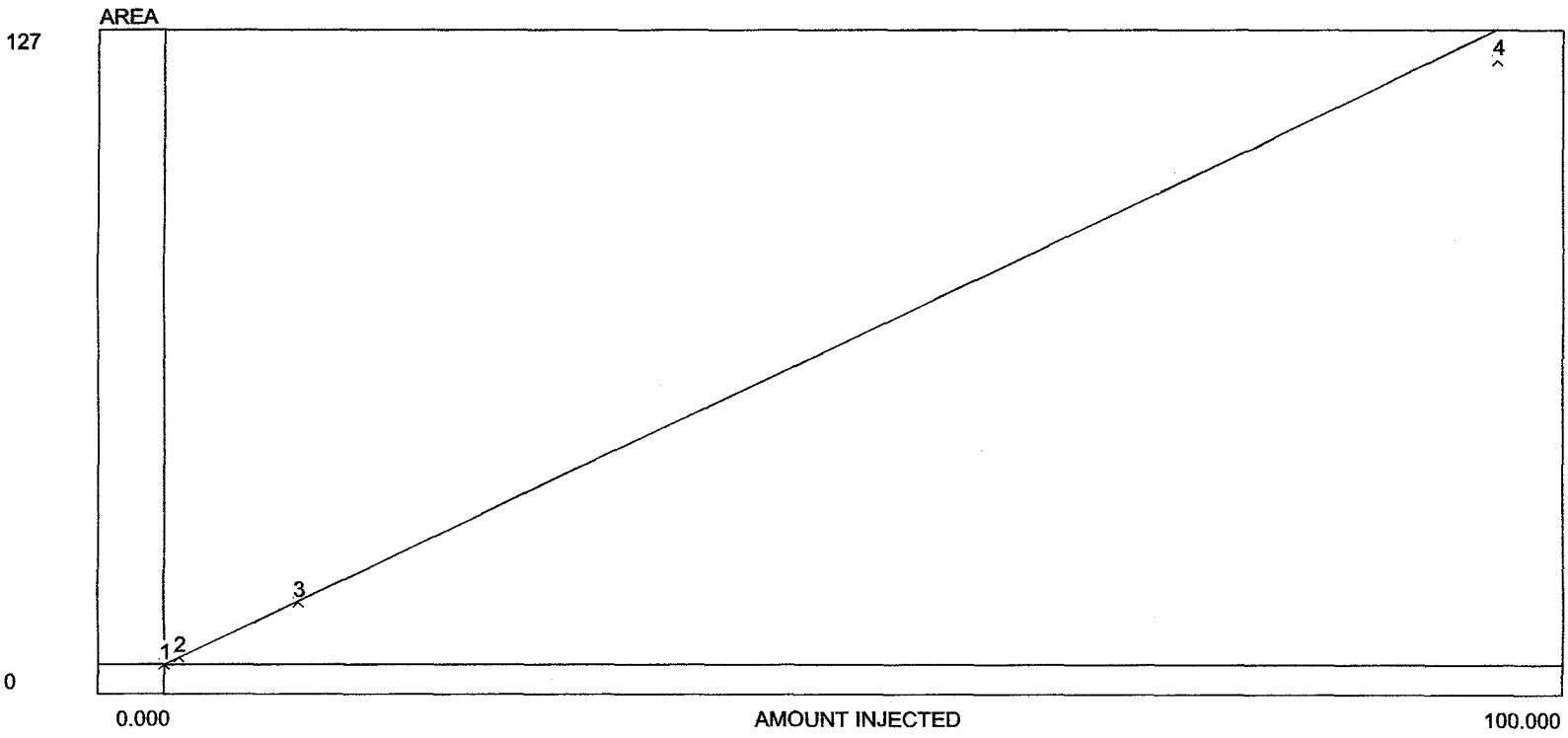
Avg slope of curve: 0.20
Y-axis intercept: 0.00
Linearity: 1.00
Number of levels: 4
SD/rel SD of CF's: 0.1/66.8
Y=0.2007X
r2: 1.0000
Last calibrated: Thu Mar 17 17:12:29 2016

Lvl.	Area/ht.	Amount	CF	Current	Previous #1	Previous #2
1	0.000	0.000	0.000	0.000	N/A	N/A
2	0.230	1.100	0.209	0.230	N/A	N/A
3	2.010	10.100	0.199	2.010	N/A	N/A
4	19.400	100.000	0.194	19.400	N/A	N/A

Component file: st32-100.cpt

Peak	Name	Start	End	Calibration	Int.Std	Units
1	Dead Vol / Air	0.000	0.350		0.000	
2	Ambient H2O	0.350	0.490		0.000	
3	Ethylene Oxide	0.490	0.600	C:\peak359\2Ster	0.00016	ppm
4	Acetaldehyde	0.600	0.800		0.000	
5	CO2	0.800	1.000		0.000	

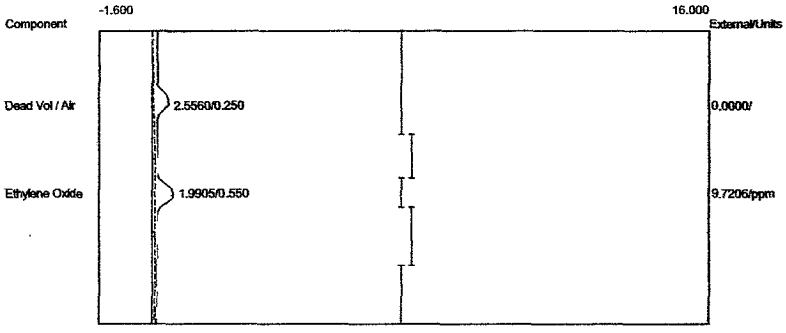
Calibration file: C:\peak359\2SterAtl-2016.cal



Avg slope of curve: 1.34
Y-axis intercept: 0.00
Linearity: 1.00
Number of levels: 4
SD/rel SD of CF's: 0.7/67.0
Y=1.3350X
r2: 1.0000
Last calibrated: Thu Mar 17 17:11:52 2016

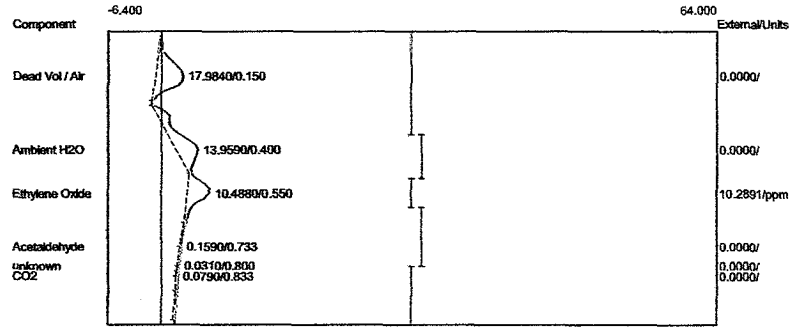
Lvl.	Area/ht.	Amount	CF	Current	Previous #1	Previous #2
1	0.000	0.000	0.000	0.000	N/A	N/A
2	1.560	1.100	1.418	1.560	N/A	N/A
3	13.300	10.100	1.317	13.300	N/A	N/A
4	127.000	100.000	1.270	127.000	N/A	N/A

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 16:29:46
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-Amb.CHR (c:\peak359)
Sample: Ambient Background
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.250	2.5560	0.0000	
Ethylene Oxide	0.550	1.9905	9.7206	ppm
		4.5465	9.7206	

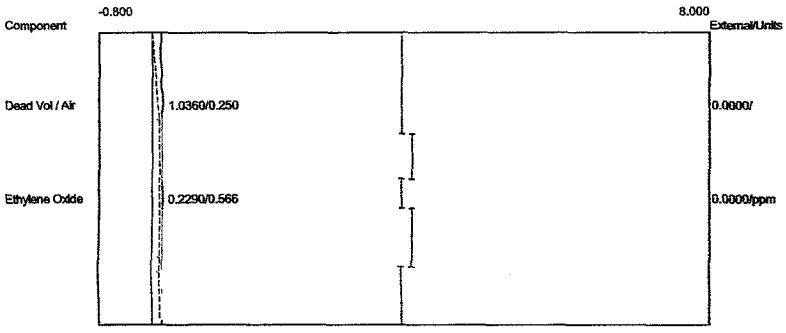
Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 16:29:46
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-Amb.CHR (c:\peak359)
Sample: Ambient Background
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.150	17.9840	0.0000	
Ambient H2O	0.400	13.9590	0.0000	
Ethylene Oxide	0.550	10.4880	10.2891	ppm
Acetaldehyde	0.733	0.1590	0.0000	
CO2	0.833	0.0790	0.0000	
		42.6690	10.2891	

Lab Name: ESC

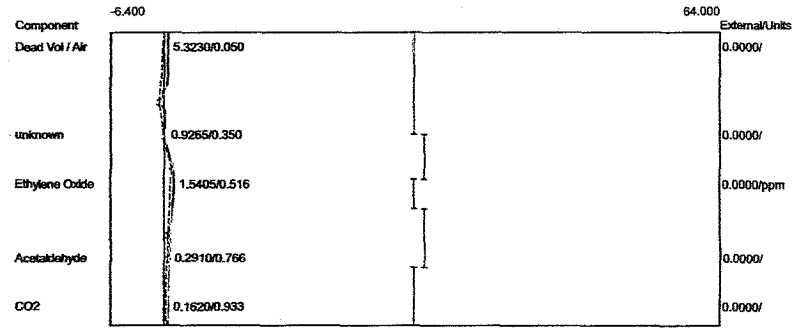
Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 16:36:23
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-C01.CHR (c:\peak359)
Sample: 1.10 ppm EtO std
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.0360	0.0000	
Ethylene Oxide	0.566	0.2290	0.0000	ppm
		1.2650	0.0000	

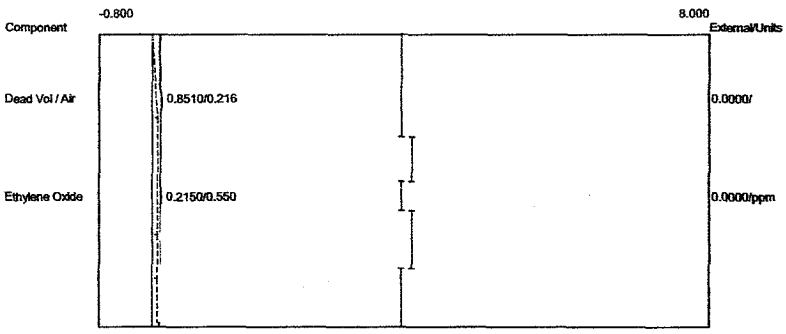
Lab Name: ESC

Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 16:36:23
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-C01.CHR (c:\peak359)
Sample: 1.10 ppm EtO std
Operator: D. Kremer



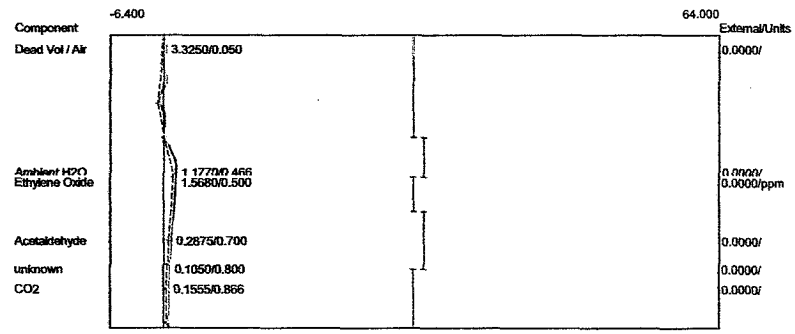
Component	Retention	Area	External	Units
Dead Vol / Air	0.050	5.3230	0.0000	
Ethylene Oxide	0.516	1.5405	0.0000	ppm
Acetaldehyde	0.766	0.2910	0.0000	
CO2	0.933	0.1620	0.0000	
		7.3165	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 16:42:02
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-C02.CHR (c:\peak359)
Sample: 1.10 ppm EtO std
Operator: D. Kremer



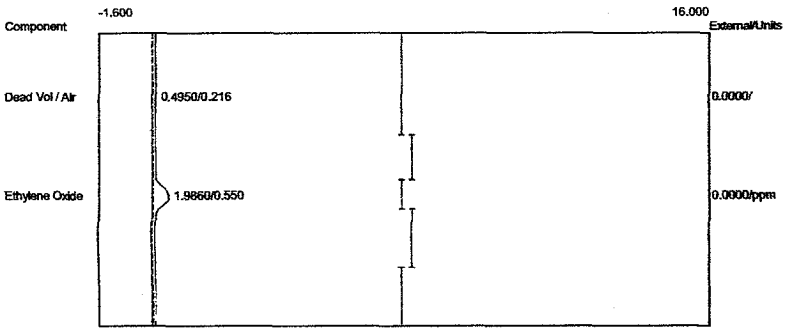
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	0.8510	0.0000	
Ethylene Oxide	0.550	0.2150	0.0000	ppm
		1.0660	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 16:42:02
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-C02.CHR (c:\peak359)
Sample: 1.10 ppm EtO std
Operator: D. Kremer



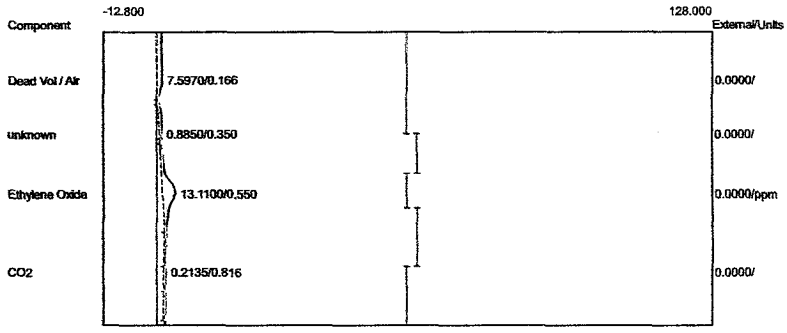
Component	Retention	Area	External	Units
Dead Vol / Air	0.050	3.3250	0.0000	
Ambient H2O	0.466	1.1770	0.0000	
Ethylene Oxide	0.500	1.5680	0.0000	ppm
Acetaldehyde	0.700	0.2875	0.0000	
CO2	0.866	0.1555	0.0000	
		6.5130	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 16:48:30
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-C03.CHR (c:\peak359)
Sample: 10.1 ppm EtO std
Operator: D. Kremer



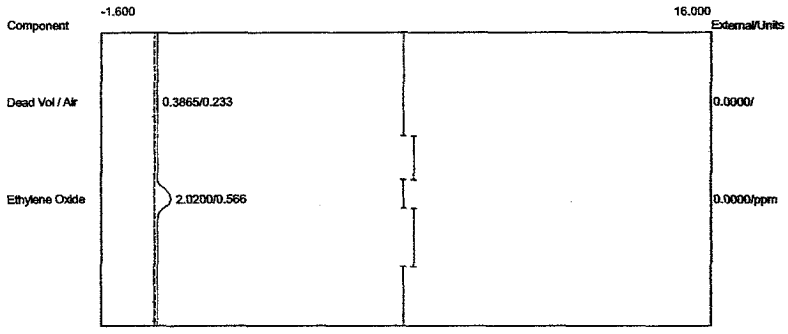
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	0.4950	0.0000	
Ethylene Oxide	0.550	1.9860	0.0000	ppm
		2.4810	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 16:48:30
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-C03.CHR (c:\peak359)
Sample: 10.1 ppm EtO std
Operator: D. Kremer



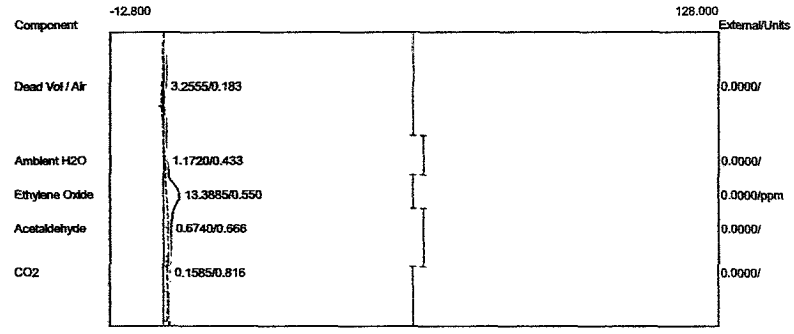
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	7.5970	0.0000	
Ethylene Oxide	0.550	13.1100	0.0000	ppm
CO2	0.816	0.2135	0.0000	
		20.9205	0.0000	

Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 16:50:18
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-C04.CHR (c:\peak359)
Sample: 10.1 ppm EtO std
Operator: D. Kremer



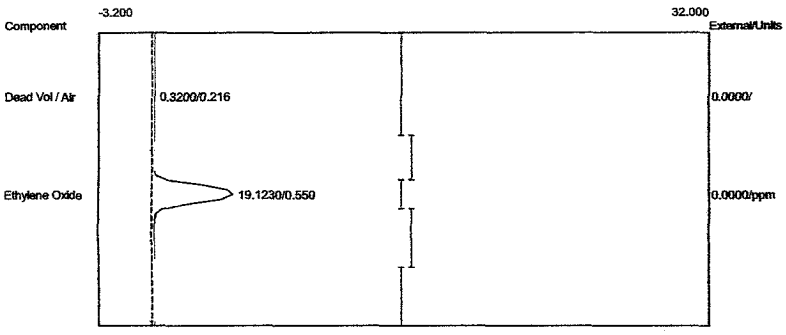
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	0.3865	0.0000	
Ethylene Oxide	0.566	2.0200	0.0000	ppm
		2.4065	0.0000	

Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 16:50:18
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-C04.CHR (c:\peak359)
Sample: 10.1 ppm EtO std
Operator: D. Kremer



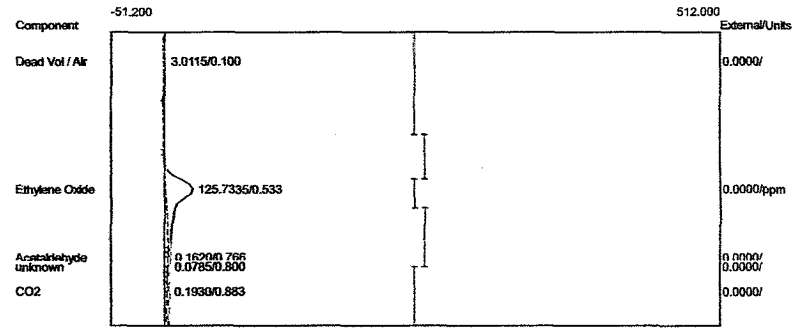
Component	Retention	Area	External	Units
Dead Vol / Air	0.183	3.2555	0.0000	
Ambient H2O	0.433	1.1720	0.0000	
Ethylene Oxide	0.550	13.3885	0.0000	ppm
Acetaldehyde	0.666	0.6740	0.0000	
CO2	0.816	0.1585	0.0000	
		18.6485	0.0000	

Lab Name: ESSI
Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 16:55:19
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-C05.CHR (c:\peak359)
Sample: 100 ppm EtO std
Operator: D. Kremer



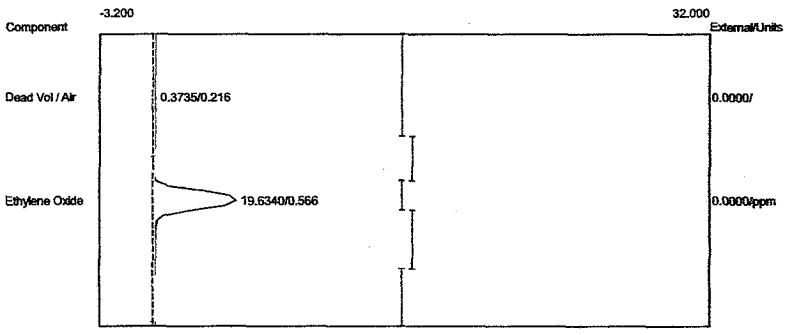
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	0.3200	0.0000	
Ethylene Oxide	0.550	19.1230	0.0000	ppm
		19.4430	0.0000	

Lab Name: ESSI
Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 16:55:19
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-C05.CHR (c:\peak359)
Sample: 100 ppm EtO std
Operator: D. Kremer



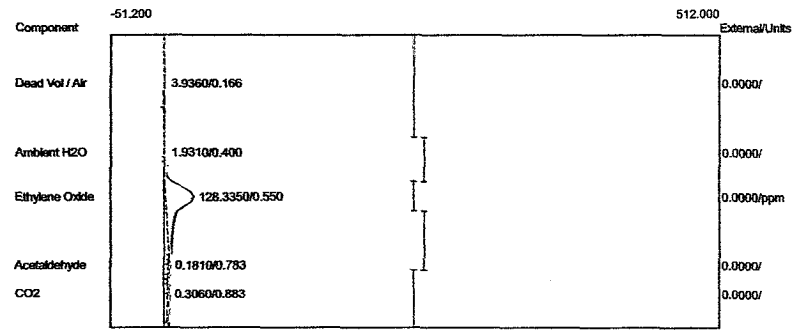
Component	Retention	Area	External	Units
Dead Vol / Air	0.100	3.0115	0.0000	
Ethylene Oxide	0.533	125.7335	0.0000	ppm
Acetaldehyde	0.766	0.1620	0.0000	
CO2	0.883	0.1930	0.0000	
		129.1000	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 16:57:53
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-C06.CHR (c:\peak359)
Sample: 100 ppm EtO std
Operator: D. Kremer



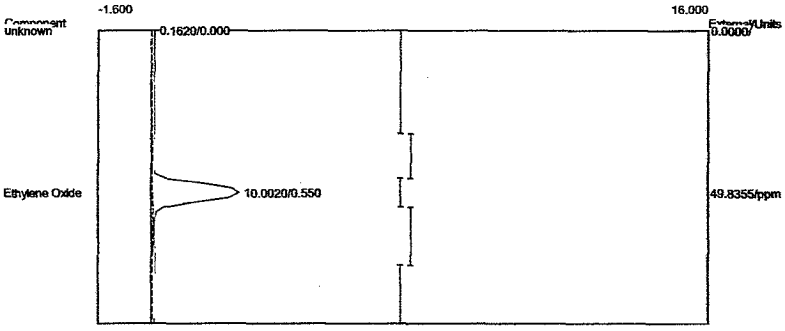
Component	Retention	Area	External	Units
Dead Vol / Air	0.216	0.3735	0.0000	
Ethylene Oxide	0.566	19.6340	0.0000	ppm
		20.0075	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 16:57:53
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-C06.CHR (c:\peak359)
Sample: 100 ppm EtO std
Operator: D. Kremer



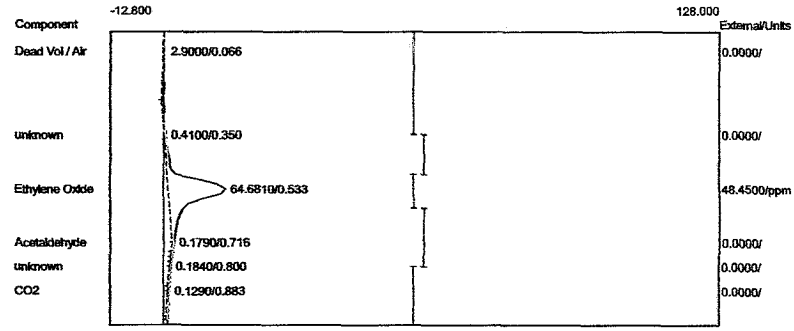
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	3.9360	0.0000	
Ambient H2O	0.400	1.9310	0.0000	
Ethylene Oxide	0.550	128.3350	0.0000	ppm
Acetaldehyde	0.783	0.1810	0.0000	
CO2	0.883	0.3060	0.0000	
		134.6890	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 17:10:35
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-C07.CHR (c:\peak359)
Sample: 48.8 ppm EtO std
Operator: D. Kremer



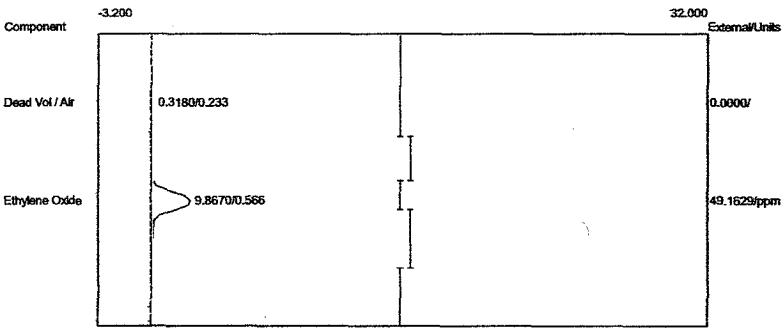
Component	Retention	Area	External	Units
Ethylene Oxide	0.550	10.0020	49.8355	ppm
		10.0020	49.8355	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: PreCal
Analysis date: 03/17/2016 17:10:35
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-C07.CHR (c:\peak359)
Sample: 48.8 ppm EtO std
Operator: D. Kremer



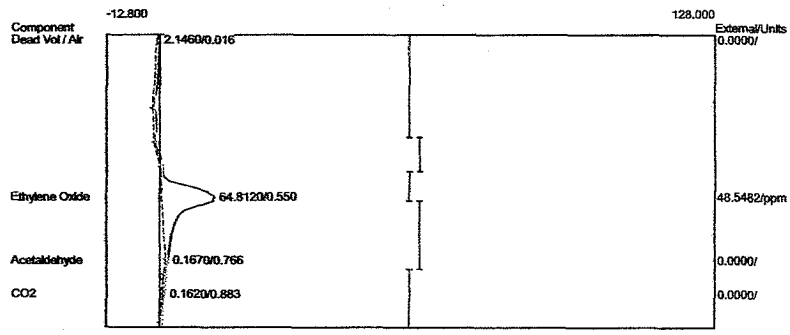
Component	Retention	Area	External	Units
Dead Vol / Air	0.066	2.9000	0.0000	
Ethylene Oxide	0.533	64.6810	48.4500	ppm
Acetaldehyde	0.716	0.1790	0.0000	
CO2	0.883	0.1290	0.0000	
		67.8890	48.4500	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: PostCal
Analysis date: 03/18/2016 12:36:57
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-C08.CHR (c:\peak359)
Sample: 48.8 ppm EtO std
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	0.3180	0.0000	
Ethylene Oxide	0.566	9.8670	49.1629	ppm
		10.1850	49.1629	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: PostCal
Analysis date: 03/18/2016 12:36:57
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-C08.CHR (c:\peak359)
Sample: 48.8 ppm EtO std
Operator: D. Kremer



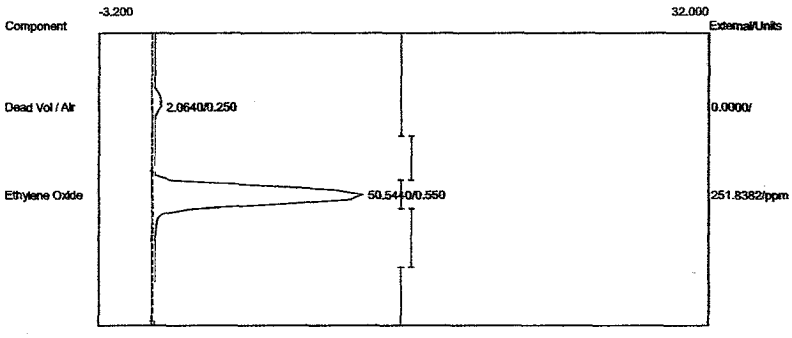
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	2.1460	0.0000	
Ethylene Oxide	0.550	64.8120	48.5482	ppm
Acetaldehyde	0.766	0.1670	0.0000	
CO2	0.883	0.1620	0.0000	
		67.2870	48.5482	

APPENDIX B

Run#1 Chromatograms

Lab Name: EOSI

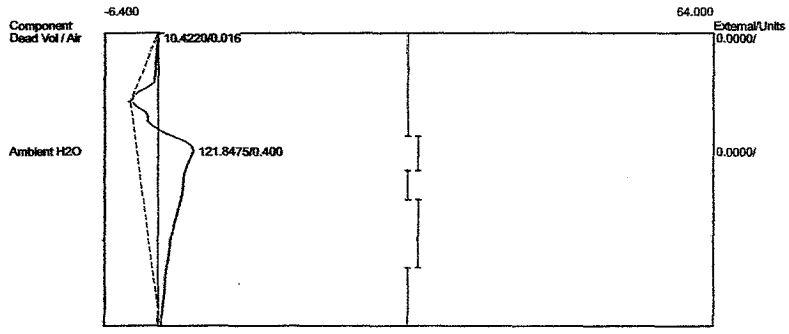
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:22:08
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-1B01.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.250	2.0640	0.0000	
Ethylene Oxide	0.550	50.5440	251.8382	ppm
		52.6080	251.8382	

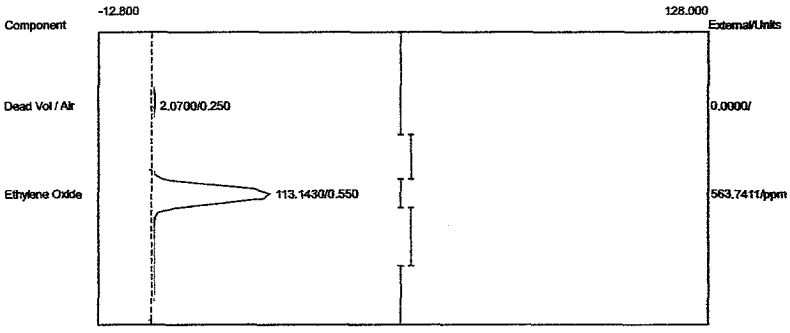
Lab Name: EOSI

Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:22:08
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-1B01.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



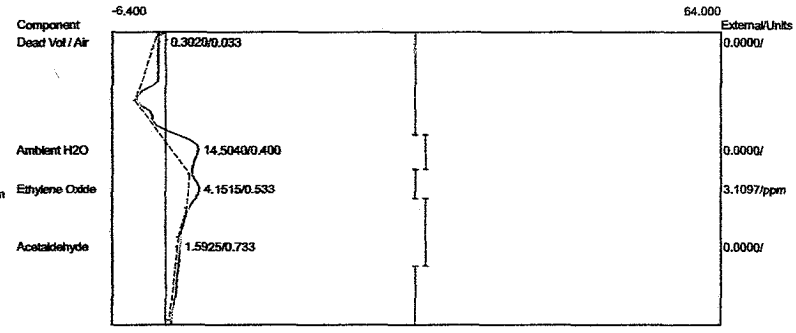
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	10.4220	0.0000	
Ambient H2O	0.400	121.8475	0.0000	
		132.2695	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:23:59
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-1B02.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



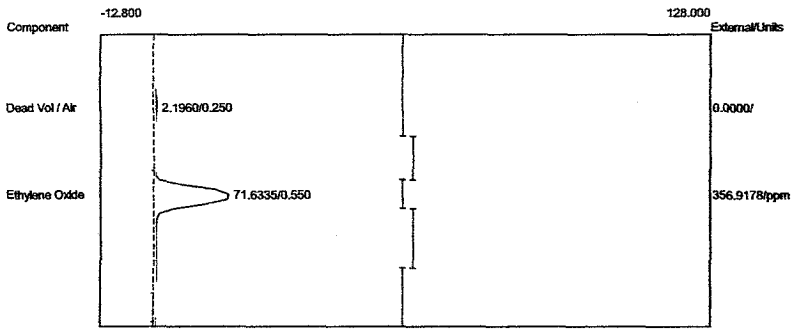
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	2.0700	0.0000	
Ethylene Oxide	0.550	113.1430	563.7411	ppm
		115.2130	563.7411	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:23:59
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-1B02.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



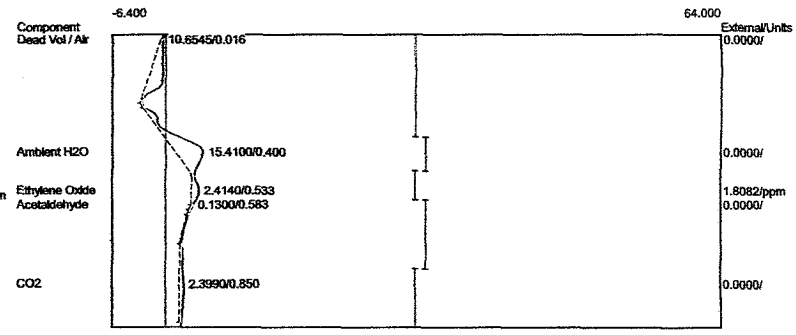
Component	Retention	Area	External	Units
Dead Vol / Air	0.033	10.3020	0.0000	
Ambient H2O	0.400	14.5040	0.0000	
Ethylene Oxide	0.533	4.1515	3.1097	ppm
Acetaldehyde	0.733	1.5925	0.0000	
		30.5500	3.1097	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:25:23
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-1B03.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



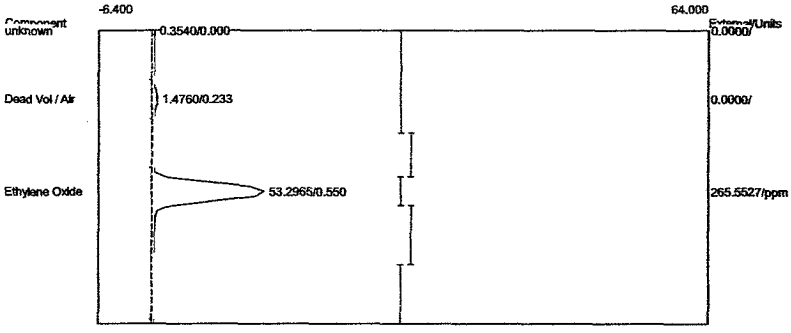
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	2.1960	0.0000	
Ethylene Oxide	0.550	71.6335	356.9178	ppm
		73.8295	356.9178	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:25:23
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-1B03.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



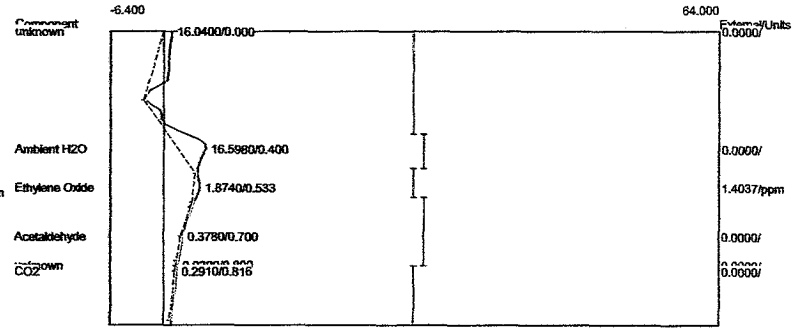
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	10.6545	0.0000	
Ambient H2O	0.400	15.4100	0.0000	
Ethylene Oxide	0.533	2.4140	1.8082	ppm
Acetaldehyde	0.583	0.1300	0.0000	
CO2	0.850	2.3990	0.0000	
		31.0075	1.8082	

Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:26:41
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-1B04.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



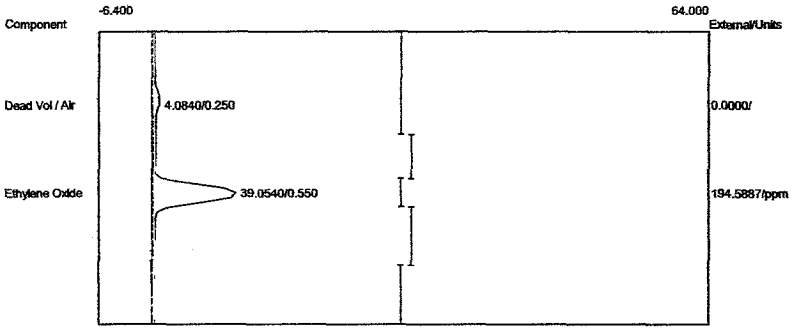
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.4760	0.0000	
Ethylene Oxide	0.550	53.2965	265.5527	ppm
		54.7725	265.5527	

Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:26:41
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-1B04.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



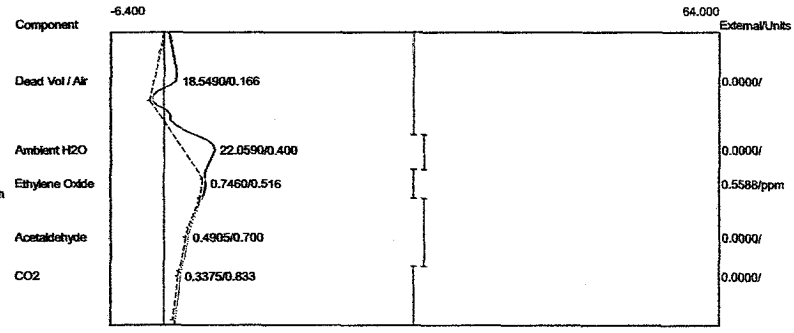
Component	Retention	Area	External	Units
Ambient H2O	0.400	16.5980	0.0000	
Ethylene Oxide	0.533	1.8740	1.4037	ppm
Acetaldehyde	0.700	0.3780	0.0000	
CO2	0.816	0.2910	0.0000	
		19.1410	1.4037	

Lab name: ESSI
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:27:58
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-1B05.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



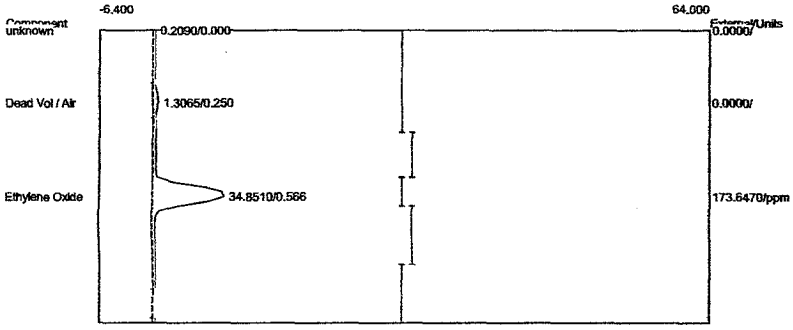
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	4.0840	0.0000	
Ethylene Oxide	0.550	39.0540	194.5887	ppm
		43.1380	194.5887	

Lab name: ESSI
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:27:58
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-1B05.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



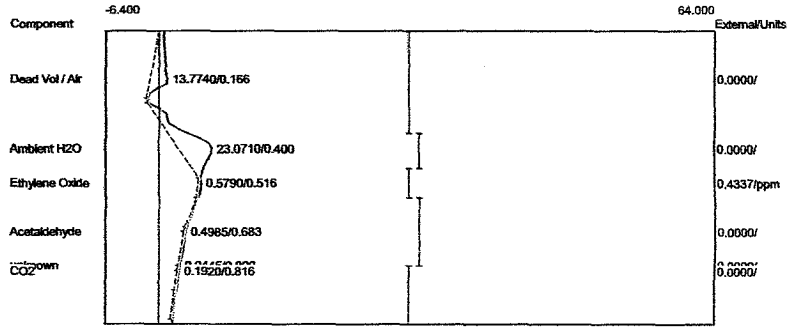
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	18.5490	0.0000	
Ambient H2O	0.400	22.0590	0.0000	
Ethylene Oxide	0.516	0.7460	0.5588	ppm
Acetaldehyde	0.700	0.4905	0.0000	
CO2	0.833	0.3375	0.0000	
		42.1820	0.5588	

Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:29:15
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-1B06.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



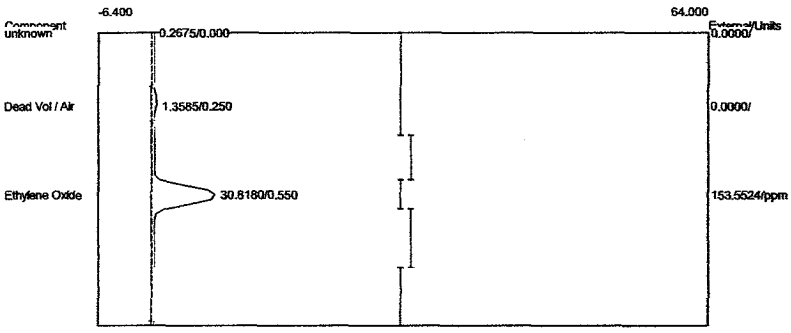
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.3065	0.0000	
Ethylene Oxide	0.566	34.8510	173.6470	ppm
		36.1575	173.6470	

Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:29:15
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-1B06.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



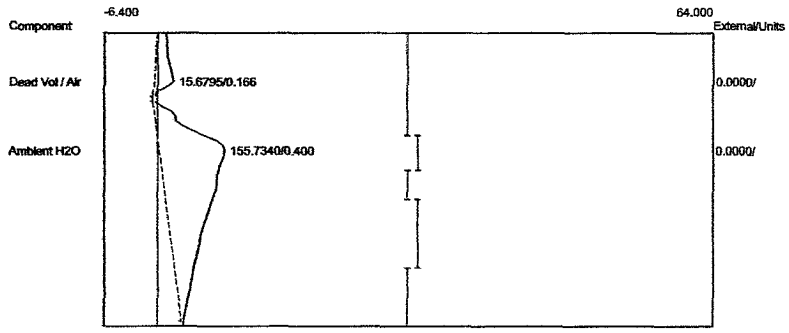
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	13.7740	0.0000	
Ambient H2O	0.400	23.0710	0.0000	
Ethylene Oxide	0.516	0.5790	0.4337	ppm
Acetaldehyde	0.683	0.4985	0.0000	
CO2	0.816	0.1920	0.0000	
		38.1145	0.4337	

Lab name: ECS
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:30:35
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-1B07.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



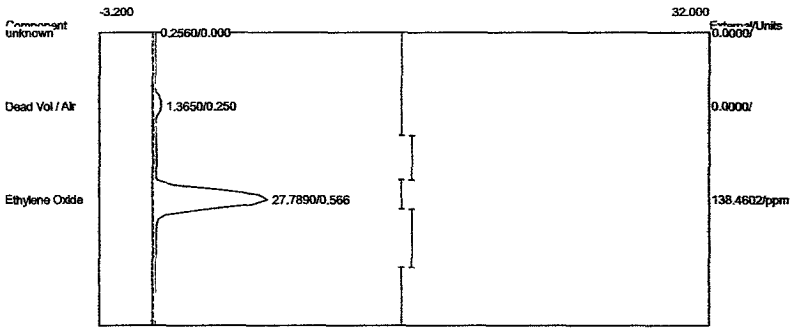
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.3585	0.0000	
Ethylene Oxide	0.550	30.8180	153.5524	ppm
		32.1765	153.5524	

Lab name: ECS
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:30:35
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-1B07.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



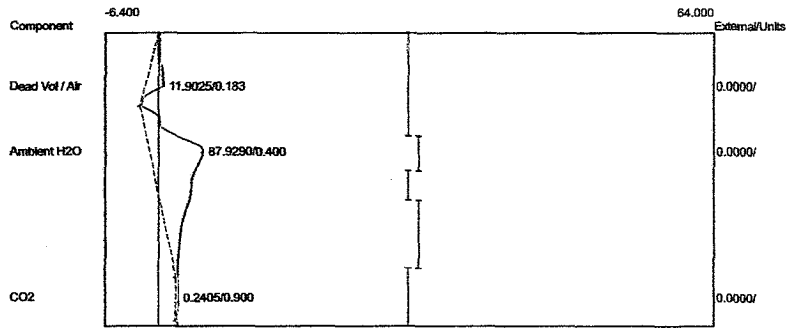
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	15.6795	0.0000	
Ambient H2O	0.400	155.7340	0.0000	
		171.4135	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:31:54
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-1B08.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



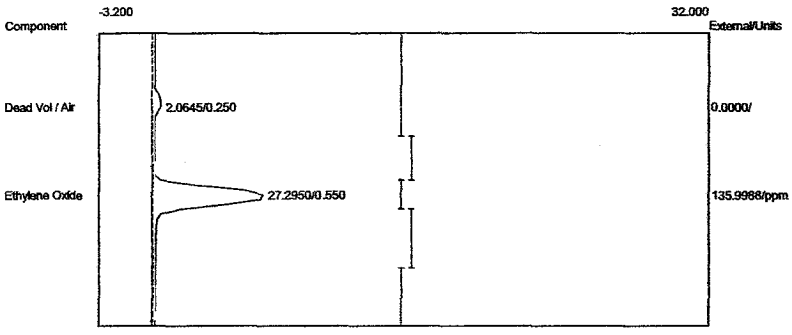
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.3650	0.0000	
Ethylene Oxide	0.566	27.7890	138.4602	ppm
		29.1540	138.4602	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:31:54
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-1B08.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



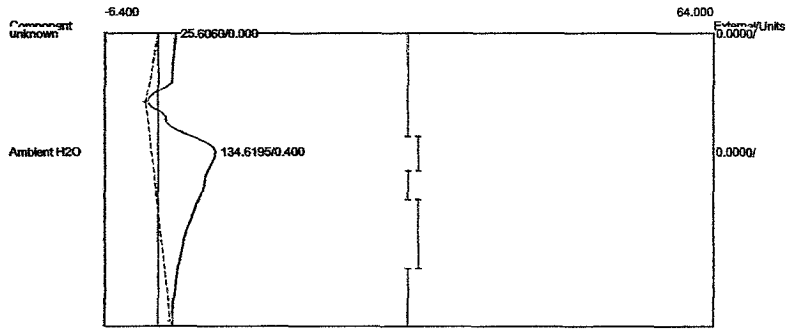
Component	Retention	Area	External	Units
Dead Vol / Air	0.183	11.9025	0.0000	
Ambient H2O	0.400	87.9290	0.0000	
CO2	0.900	0.2405	0.0000	
		100.0720	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:32:58
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-1B09.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



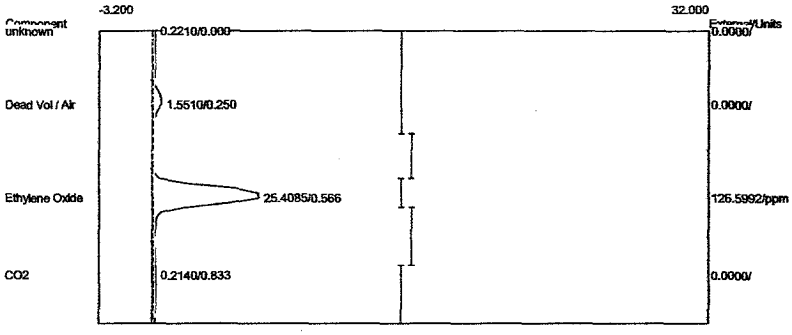
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	2.0645	0.0000	
Ethylene Oxide	0.550	27.2950	135.9988	ppm
		29.3595	135.9988	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:32:58
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-1B09.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



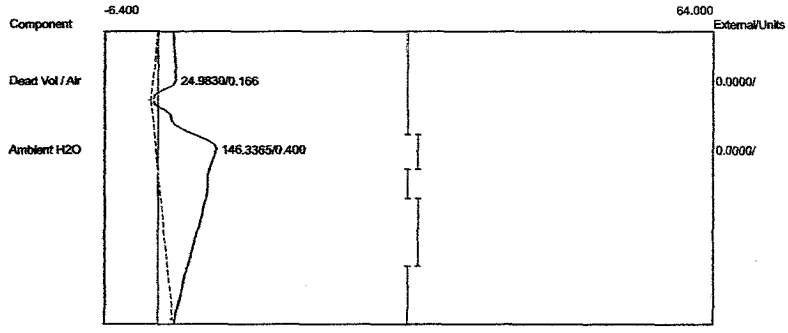
Component	Retention	Area	External	Units
Ambient H2O	0.400	134.6195	0.0000	
		134.6195	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:34:05
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-1B10.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



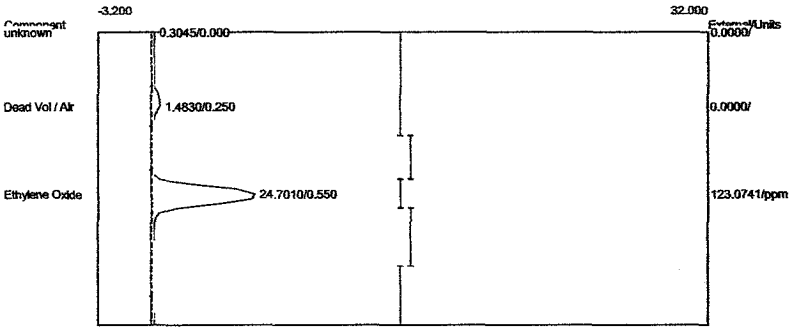
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.5510	0.0000	
Ethylene Oxide	0.566	25.4085	126.5992	ppm
CO2	0.833	0.2140	0.0000	
		27.1735	126.5992	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:34:05
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-1B10.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



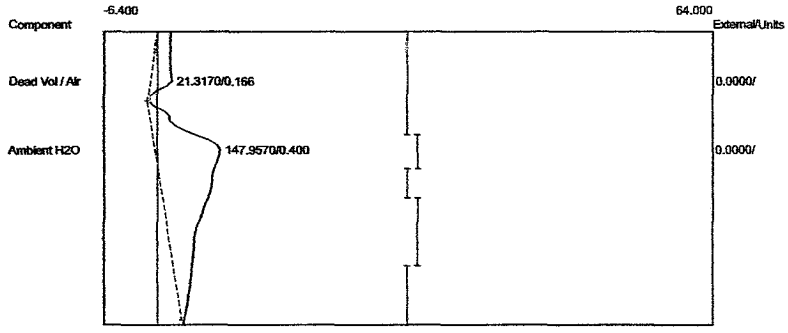
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	24.9830	0.0000	
Ambient H2O	0.400	146.3365	0.0000	
		171.3195	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:35:11
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-1B11.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.4830	0.0000	
Ethylene Oxide	0.550	24.7010	123.0741	ppm
		26.1840	123.0741	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#1BV
Analysis date: 03/17/2016 22:35:11
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-1B11.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

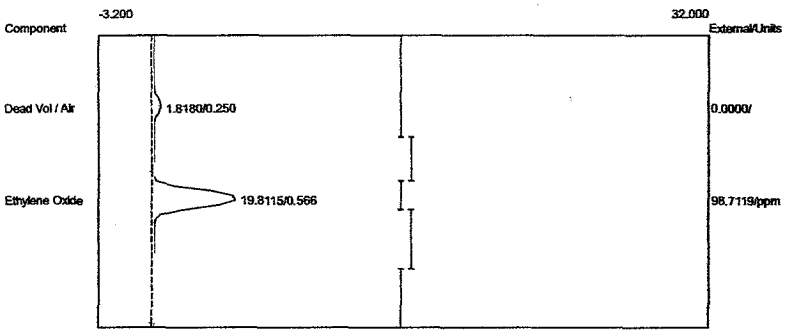


Component	Retention	Area	External	Units
Dead Vol / Air	0.166	21.3170	0.0000	
Ambient H2O	0.400	147.9570	0.0000	
		169.2740	0.0000	

APPENDIX C

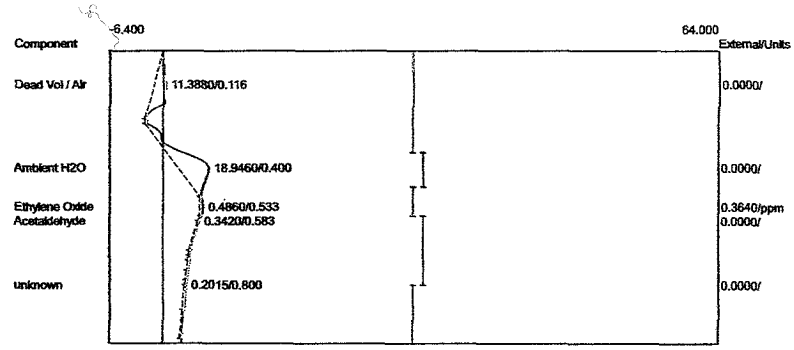
Run#2 Chromatograms

Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 22:54:18
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-2B01.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



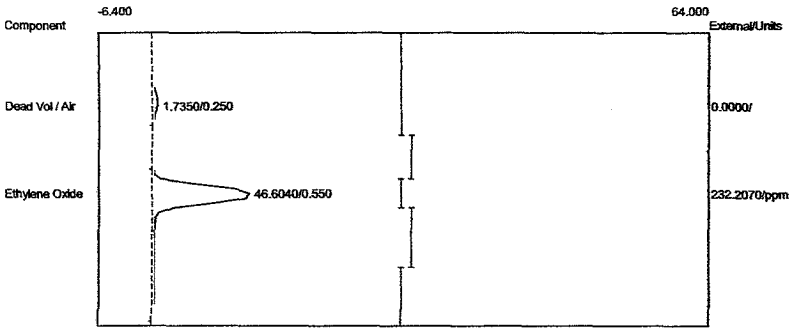
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.8180	0.0000	
Ethylene Oxide	0.566	19.8115	98.7119	ppm
		21.6295	98.7119	

Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 22:54:18
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-2B01.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



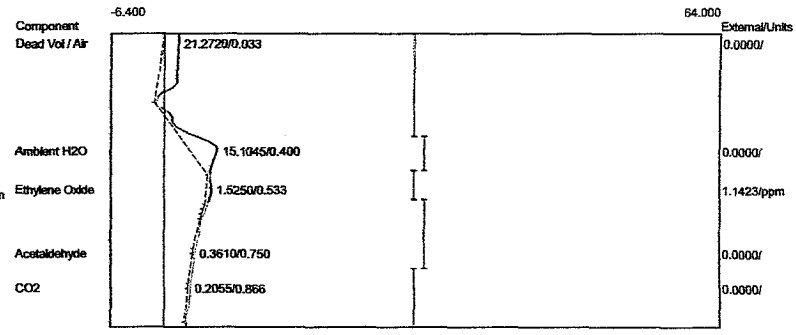
Component	Retention	Area	External	Units
Dead Vol / Air	0.116	11.3880	0.0000	
Ambient H2O	0.400	18.9460	0.0000	
Ethylene Oxide	0.533	0.4860	0.3640	ppm
Acetaldehyde	0.583	0.3420	0.0000	
		31.1620	0.3640	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 22:55:33
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-2B02.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



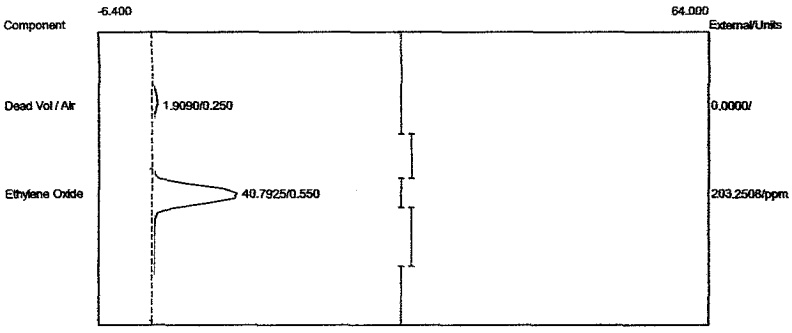
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.7350	0.0000	
Ethylene Oxide	0.550	46.6040	232.2070	ppm
		48.3390	232.2070	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 22:55:33
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-2B02.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



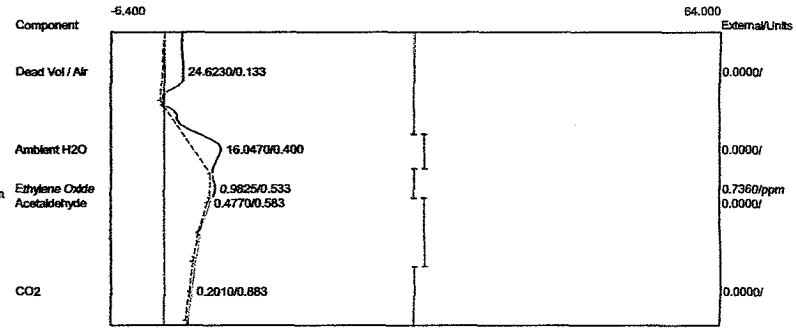
Component	Retention	Area	External	Units
Dead Vol / Air	0.033	21.2720	0.0000	
Ambient H2O	0.400	15.1045	0.0000	
Ethylene Oxide	0.533	1.5250	1.1423	ppm
Acetaldehyde	0.750	0.3610	0.0000	
CO2	0.866	0.2055	0.0000	
		38.4680	1.1423	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 22:56:48
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-2B03.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



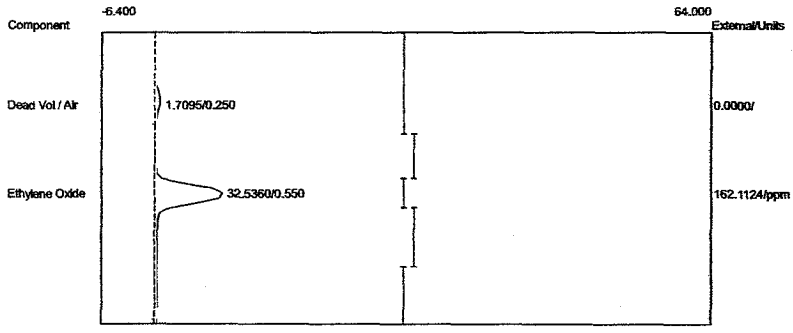
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.9090	0.0000	
Ethylene Oxide	0.550	40.7925	203.2508	ppm
		42.7015	203.2508	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 22:56:48
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-2B03.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



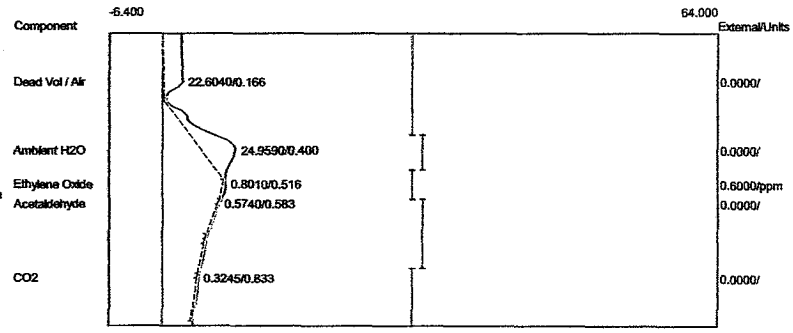
Component	Retention	Area	External	Units
Dead Vol / Air	0.133	24.6230	0.0000	
Ambient H2O	0.400	16.0470	0.0000	
Ethylene Oxide	0.533	0.9825	0.7360	ppm
Acetaldehyde	0.583	0.4770	0.0000	
CO2	0.883	0.2010	0.0000	
		42.3305	0.7360	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 22:58:03
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-2B04.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



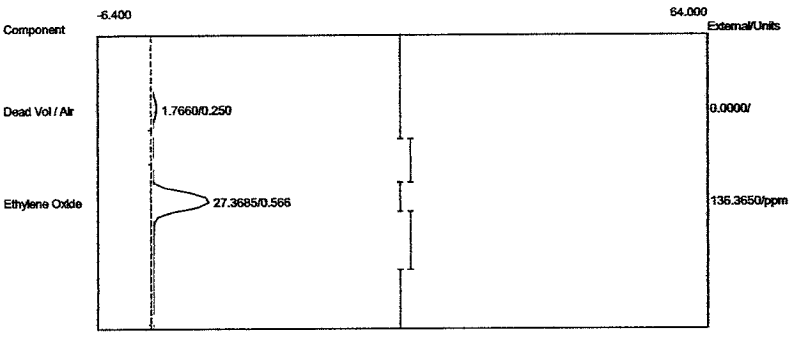
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.7095	0.0000	
Ethylene Oxide	0.550	32.5360	162.1124	ppm
		34.2455	162.1124	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 22:58:03
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-2B04.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



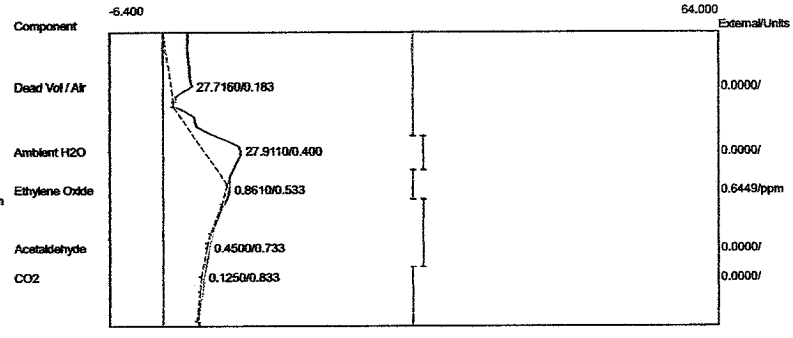
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	22.6040	0.0000	
Ambient H2O	0.400	24.9590	0.0000	
Ethylene Oxide	0.516	0.8010	0.6000	ppm
Acetaldehyde	0.583	0.5740	0.0000	
CO2	0.833	0.3245	0.0000	
		49.2625	0.6000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 22:59:19
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-2B05.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



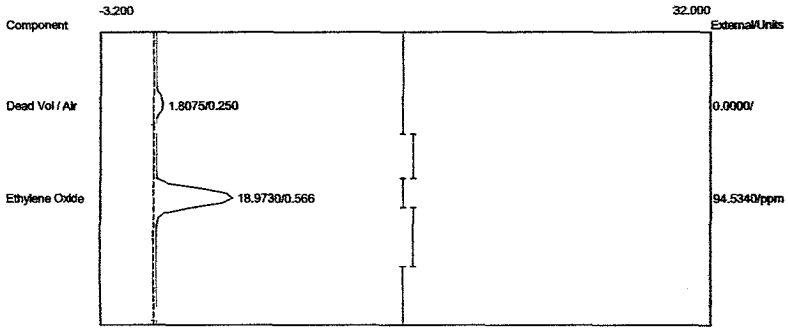
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.7660	0.0000	
Ethylene Oxide	0.566	27.3685	136.3650	ppm
		29.1345	136.3650	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 22:59:19
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-2B05.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



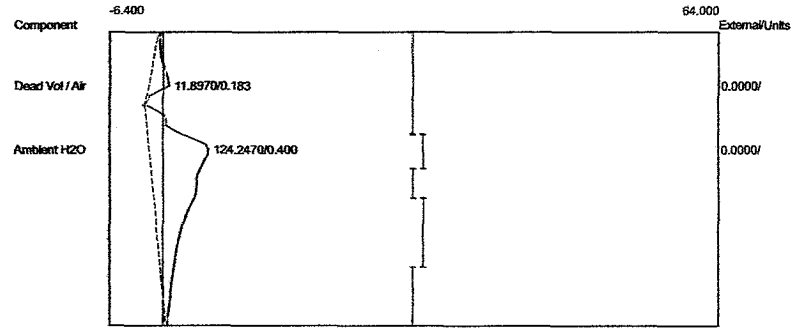
Component	Retention	Area	External	Units
Dead Vol / Air	0.183	27.7160	0.0000	
Ambient H2O	0.400	27.9110	0.0000	
Ethylene Oxide	0.533	0.8610	0.6449	ppm
Acetaldehyde	0.733	0.4500	0.0000	
CO2	0.833	0.1250	0.0000	
		57.0630	0.6449	

Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 23:00:39
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-2B06.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



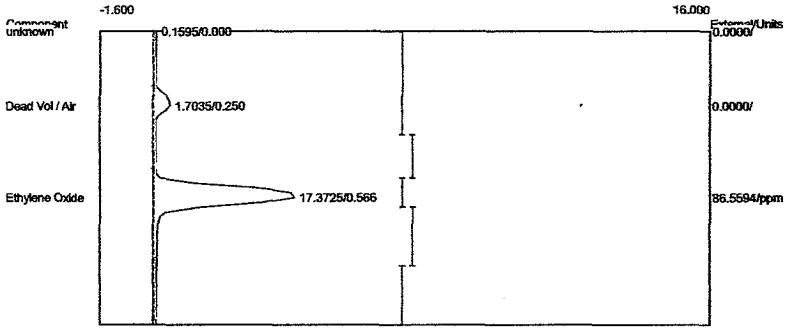
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.8075	0.0000	
Ethylene Oxide	0.566	18.9730	94.5340	ppm
		20.7805	94.5340	

Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 23:00:39
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-2B06.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



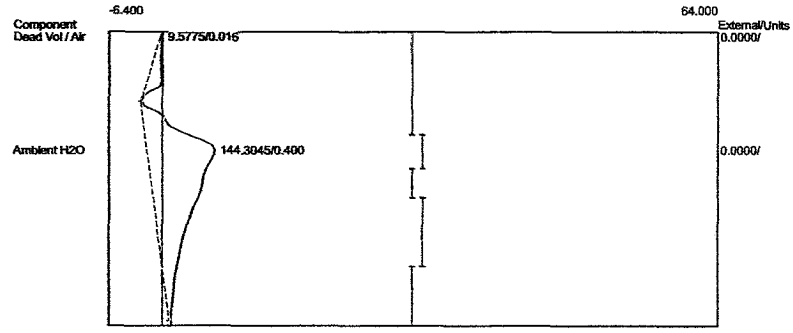
Component	Retention	Area	External	Units
Dead Vol / Air	0.183	11.8970	0.0000	
Ambient H2O	0.400	124.2470	0.0000	
		136.1440	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 23:01:45
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-2B07.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



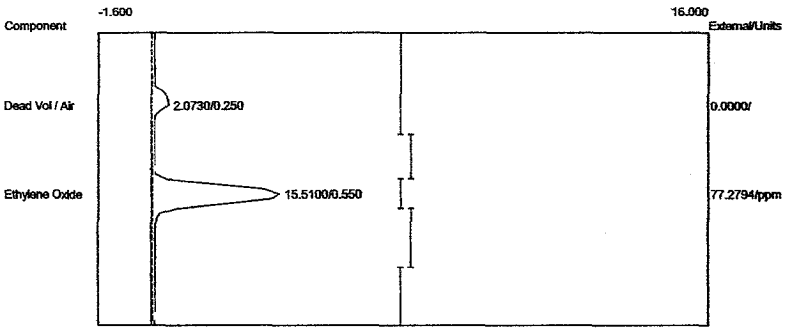
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.7035	0.0000	
Ethylene Oxide	0.566	17.3725	86.5594	ppm
		19.0760	86.5594	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 23:01:45
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-2B07.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



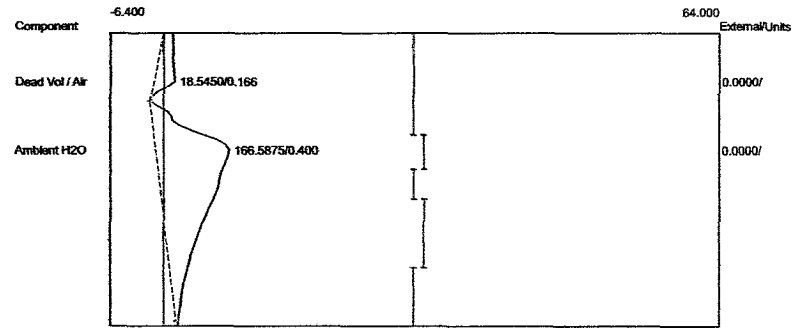
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	9.5775	0.0000	
Ambient H2O	0.400	144.3045	0.0000	
		153.8820	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 23:02:57
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-2B08.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



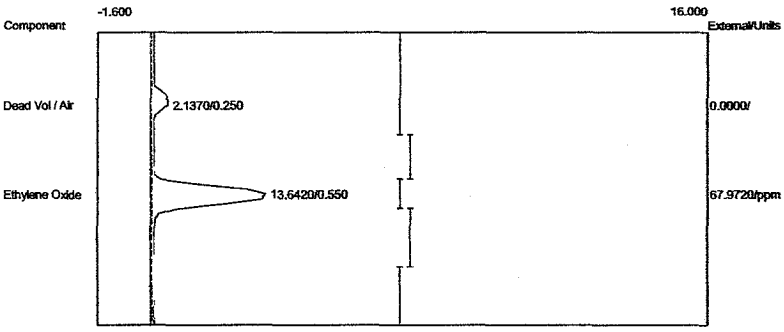
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	2.0730	0.0000	
Ethylene Oxide	0.550	15.5100	77.2794	ppm
		17.5830	77.2794	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 23:02:57
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-2B08.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



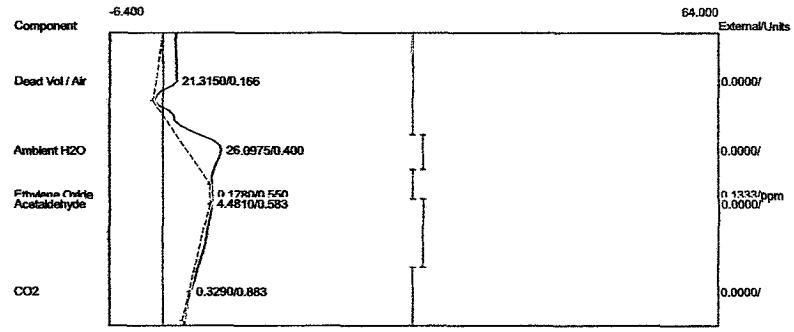
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	18.5450	0.0000	
Ambient H2O	0.400	166.5875	0.0000	
		185.1325	0.0000	

Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 23:04:03
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-2B09.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



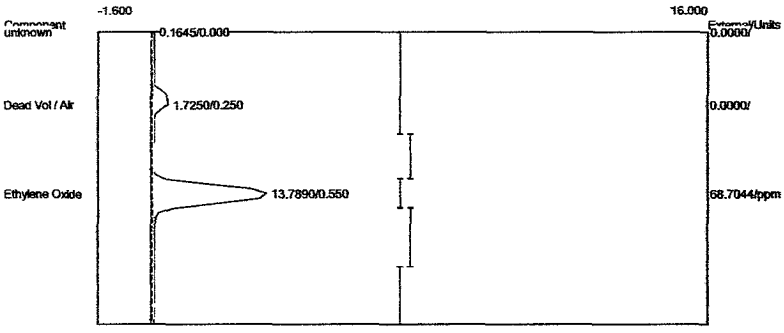
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	2.1370	0.0000	
Ethylene Oxide	0.550	13.6420	67.9720	ppm
		15.7790	67.9720	

Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 23:04:03
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-2B09.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



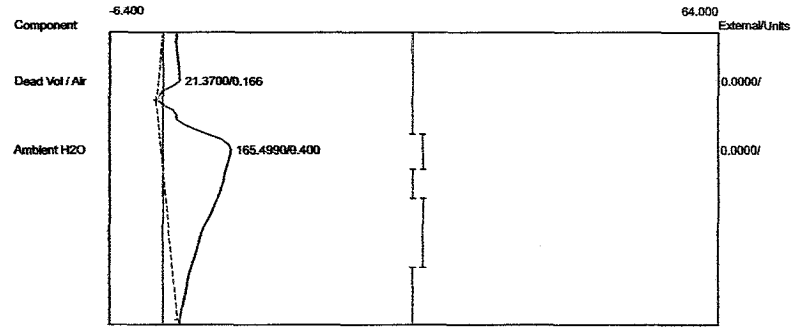
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	21.3150	0.0000	
Ambient H2O	0.400	26.0975	0.0000	
Ethylene Oxide	0.550	0.1780	0.1333	ppm
Acetaldehyde	0.583	4.4810	0.0000	
CO2	0.883	0.3290	0.0000	
		52.4005	0.1333	

Lab name: EOSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 23:05:23
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-2B10.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



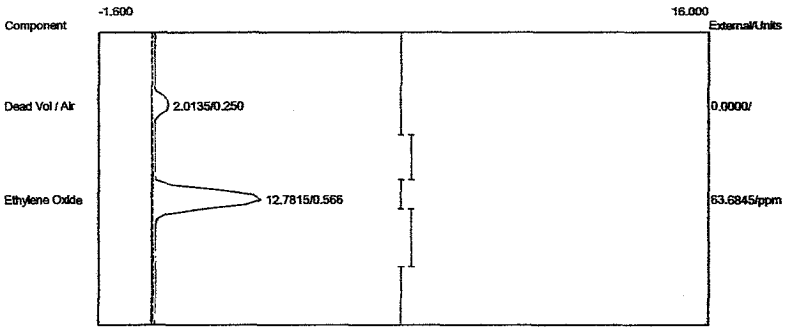
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.7250	0.0000	
Ethylene Oxide	0.550	13.7890	68.7044	ppm
		15.5140	68.7044	

Lab name: EOSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 23:05:23
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-2B10.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



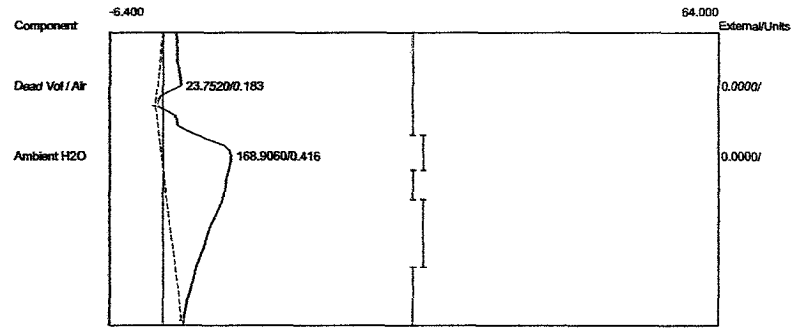
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	21.3700	0.0000	
Ambient H2O	0.400	165.4990	0.0000	
		186.8690	0.0000	

Lab Name: EOSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 23:06:33
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-2B11.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



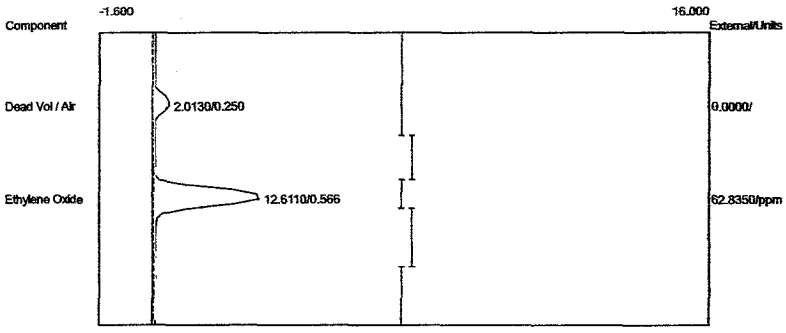
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	2.0135	0.0000	
Ethylene Oxide	0.566	12.7815	63.6845	ppm
		14.7950	63.6845	

Lab Name: EOSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 23:06:33
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-2B11.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



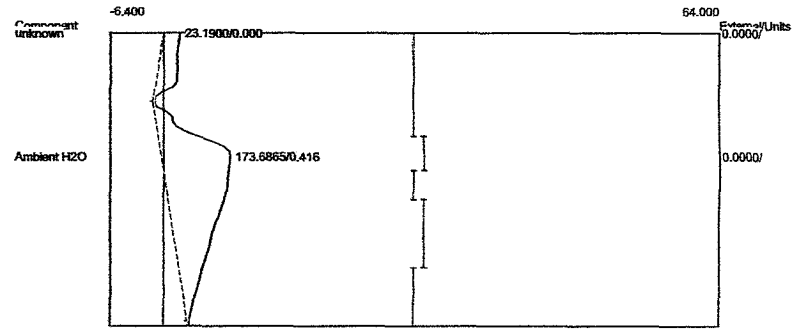
Component	Retention	Area	External	Units
Dead Vol / Air	0.183	23.7520	0.0000	
Ambient H2O	0.416	168.9060	0.0000	
		192.6580	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 23:07:38
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-2B12.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.250	2.0130	0.0000	
Ethylene Oxide	0.566	12.6110	62.8350	ppm
		14.6240	62.8350	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#2BV
Analysis date: 03/17/2016 23:07:38
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-2B12.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer

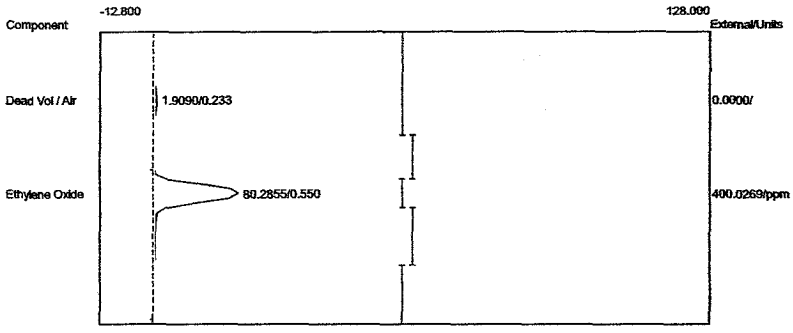


Component	Retention	Area	External	Units
Ambient H2O	0.416	173.6865	0.0000	
		173.6865	0.0000	

APPENDIX D

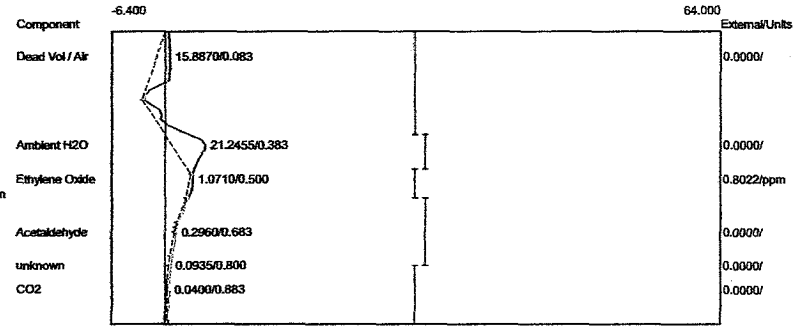
Run#3 Chromatograms

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:11:43
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-3B01.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



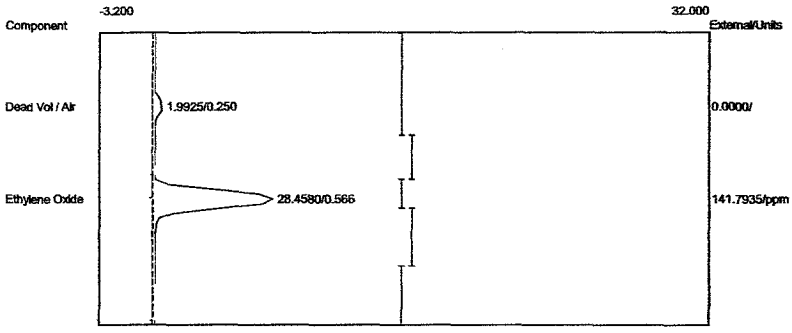
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.9090	0.0000	
Ethylene Oxide	0.550	80.2855	400.0269	ppm
		82.1945	400.0269	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:11:43
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-3B01.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



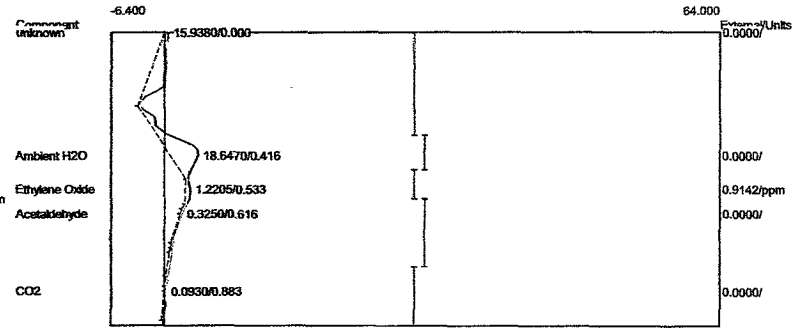
Component	Retention	Area	External	Units
Dead Vol / Air	0.083	15.8870	0.0000	
Ambient H2O	0.383	21.2455	0.0000	
Ethylene Oxide	0.500	1.0710	0.8022	ppm
Acetaldehyde	0.683	0.2960	0.0000	
CO2	0.883	0.0400	0.0000	
		38.5395	0.8022	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:12:59
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-3B02.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



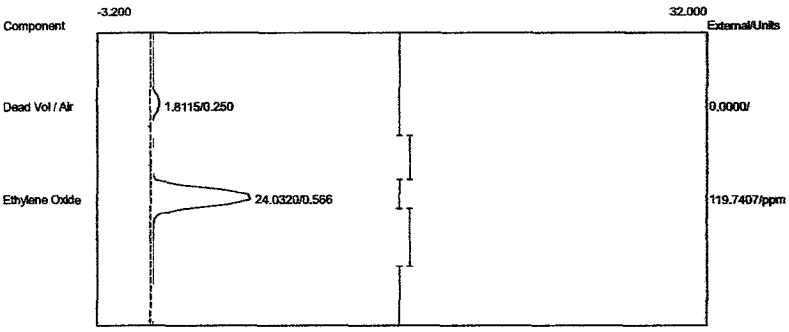
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.9925	0.0000	
Ethylene Oxide	0.566	28.4580	141.7935	ppm
		30.4505	141.7935	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:12:59
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-3B02.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



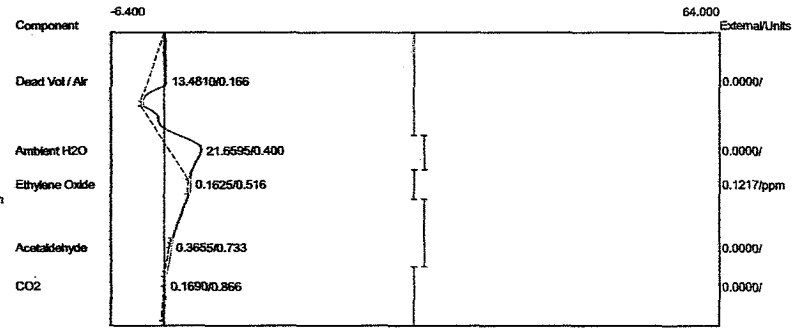
Component	Retention	Area	External	Units
Ambient H2O	0.416	18.6470	0.0000	
Ethylene Oxide	0.533	1.2205	0.9142	ppm
Acetaldehyde	0.616	0.3250	0.0000	
CO2	0.883	0.0930	0.0000	
		20.2855	0.9142	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:14:11
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-3B03.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



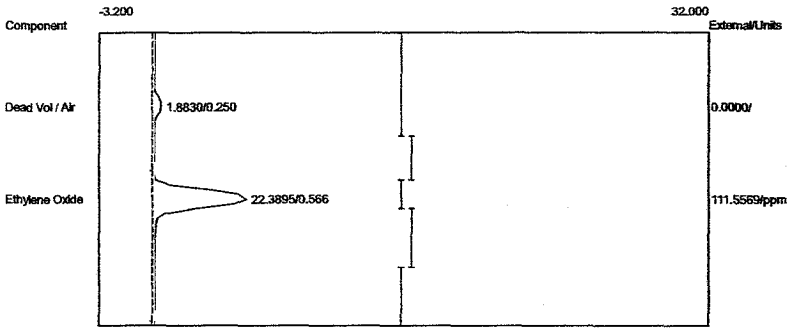
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.8115	0.0000	
Ethylene Oxide	0.566	24.0320	119.7407	ppm
		25.8435	119.7407	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:14:11
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-3B03.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



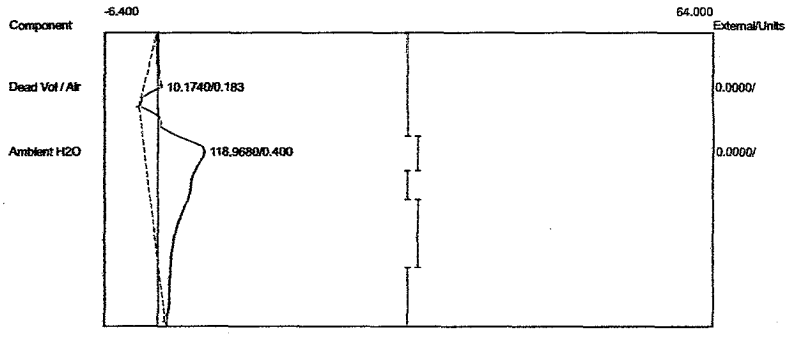
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	13.4810	0.0000	
Ambient H2O	0.400	21.6595	0.0000	
Ethylene Oxide	0.516	0.1625	0.1217	ppm
Acetaldehyde	0.733	0.3655	0.0000	
CO2	0.866	0.1690	0.0000	
		35.8375	0.1217	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:15:28
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-3B04.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



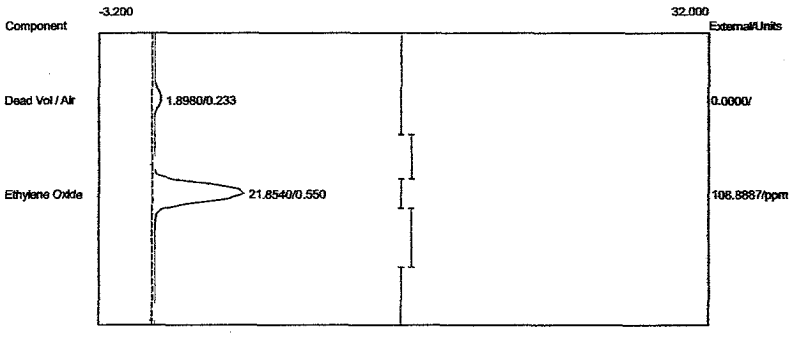
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.8830	0.0000	
Ethylene Oxide	0.566	22.3895	111.5569	ppm
		24.2725	111.5569	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:15:28
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-3B04.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



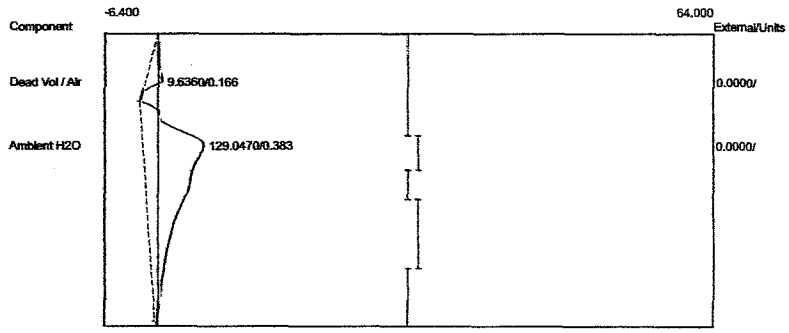
Component	Retention	Area	External	Units
Dead Vol / Air	0.183	10.1740	0.0000	
Ambient H2O	0.400	118.9680	0.0000	
		129.1420	0.0000	

Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:16:46
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-3B05.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



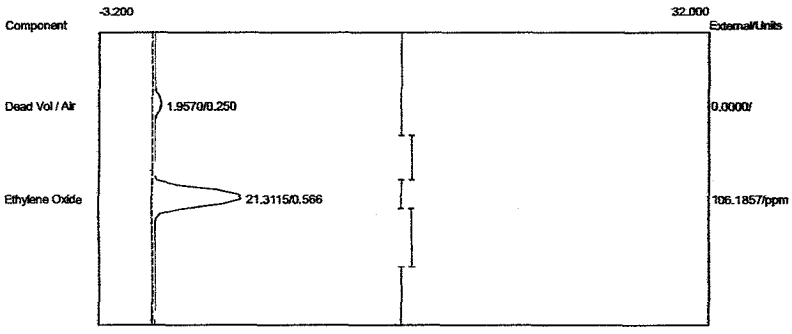
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.8980	0.0000	
Ethylene Oxide	0.550	21.8540	108.8887	ppm
		23.7520	108.8887	

Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:16:46
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-3B05.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



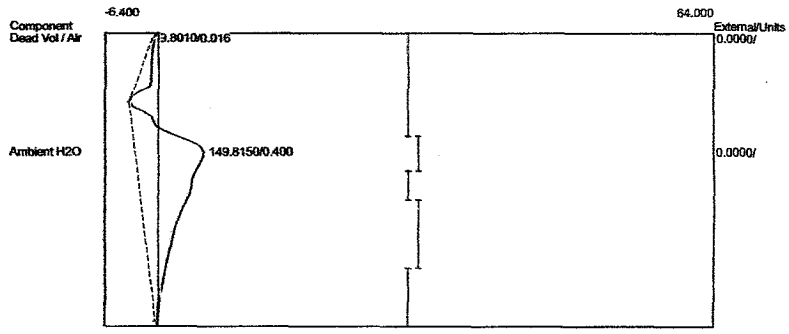
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	9.6360	0.0000	
Ambient H2O	0.383	129.0470	0.0000	
		138.6830	0.0000	

Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:17:52
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-3B06.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



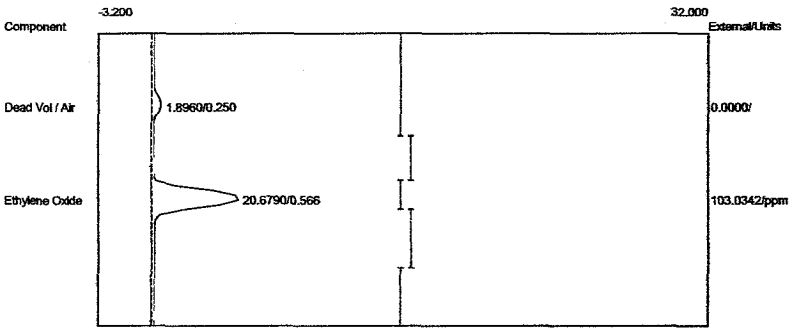
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.9570	0.0000	
Ethylene Oxide	0.566	21.3115	106.1857	ppm
		23.2685	106.1857	

Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:17:52
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-3B06.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



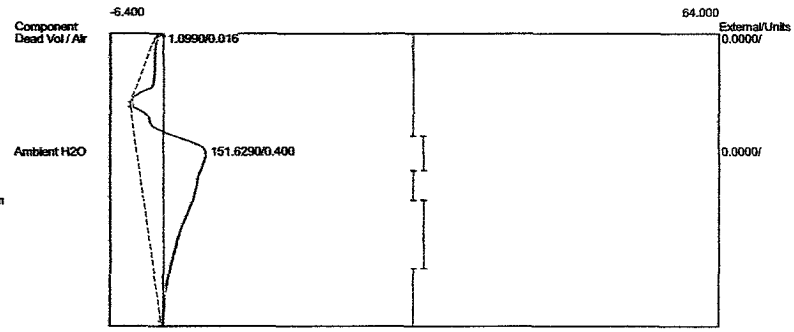
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	9.8010	0.0000	
Ambient H2O	0.400	149.8150	0.0000	
		159.6160	0.0000	

Lab name: ESSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:19:06
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-3B07.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



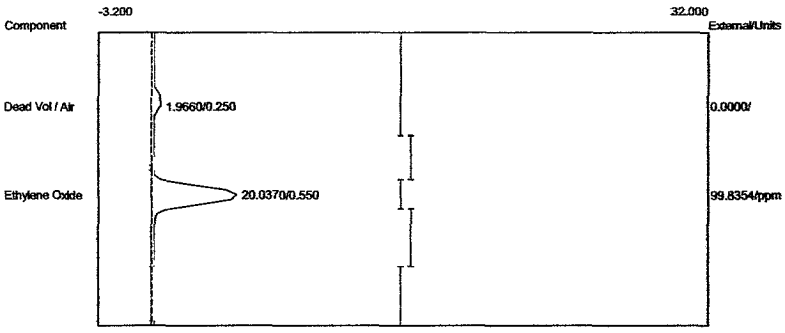
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.8960	0.0000	
Ethylene Oxide	0.566	20.6790	103.0342	ppm
		22.5750	103.0342	

Lab name: ESSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:19:06
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-3B07.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



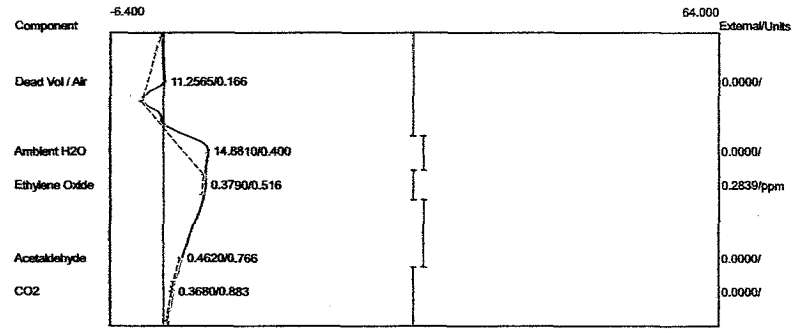
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	11.0990	0.0000	
Ambient H2O	0.400	151.6290	0.0000	
		162.7280	0.0000	

Lab Name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:20:18
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-3B08.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



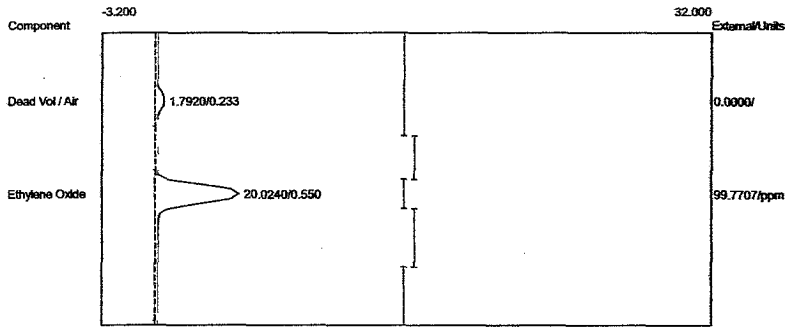
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.9660	0.0000	
Ethylene Oxide	0.550	20.0370	99.8354	ppm
		22.0030	99.8354	

Lab Name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:20:18
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-3B08.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



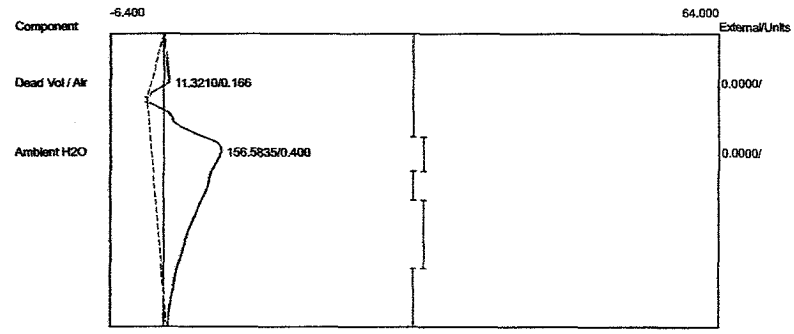
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	11.2565	0.0000	
Ambient H2O	0.400	14.8810	0.0000	
Ethylene Oxide	0.516	0.3790	0.2839	ppm
Acetaldehyde	0.766	0.4620	0.0000	
CO2	0.883	0.3680	0.0000	
		27.3465	0.2839	

Lab name: EOSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:21:35
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-3B09.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



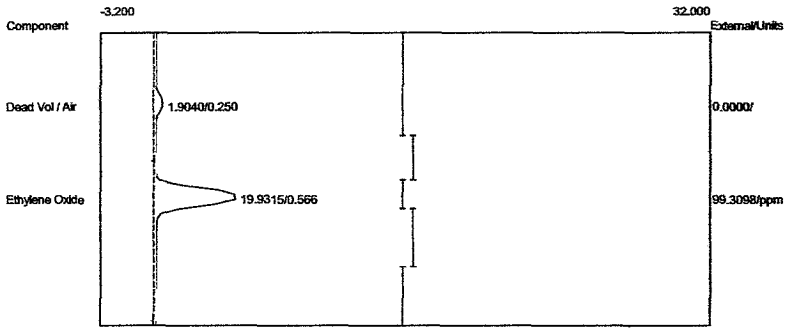
Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.7920	0.0000	
Ethylene Oxide	0.550	20.0240	99.7707	ppm
		21.8160	99.7707	

Lab name: EOSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:21:35
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-3B09.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



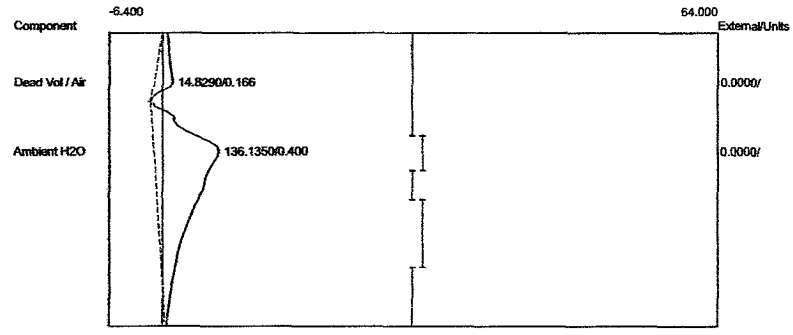
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	11.3210	0.0000	
Ambient H2O	0.400	156.5835	0.0000	
		167.9045	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:22:52
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-3B10.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



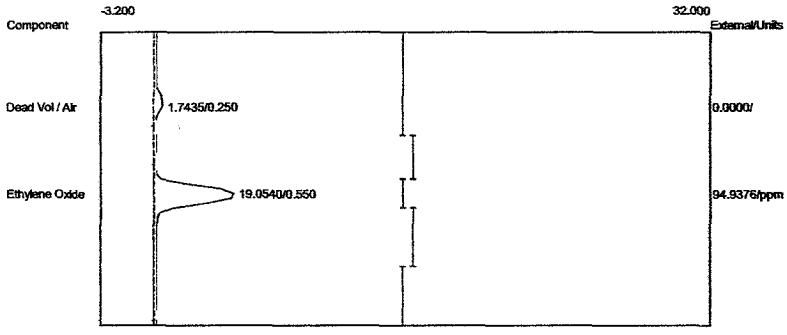
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.9040	0.0000	
Ethylene Oxide	0.566	19.9315	99.3098	ppm
		21.8355	99.3098	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:22:52
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-3B10.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



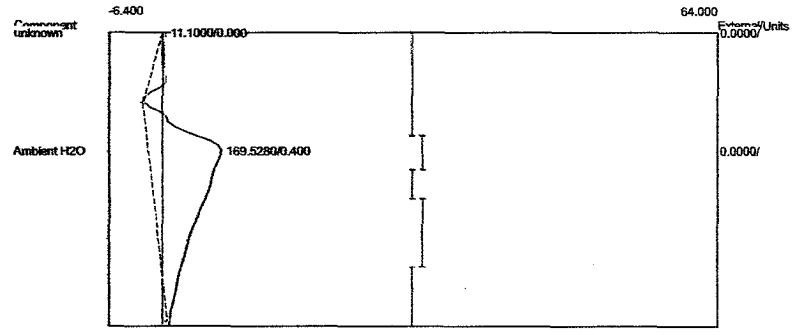
Component	Retention	Area	External	Units
Dead Vol / Air	0.166	14.8290	0.0000	
Ambient H2O	0.400	136.1350	0.0000	
		150.9640	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:23:57
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-3B11.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



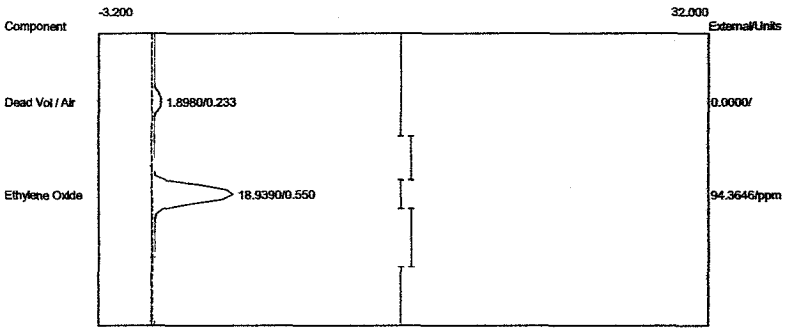
Component	Retention	Area	External	Units
Dead Vol / Air	0.250	1.7435	0.0000	
Ethylene Oxide	0.550	19.0540	94.9376	ppm
		20.7975	94.9376	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:23:57
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-3B11.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



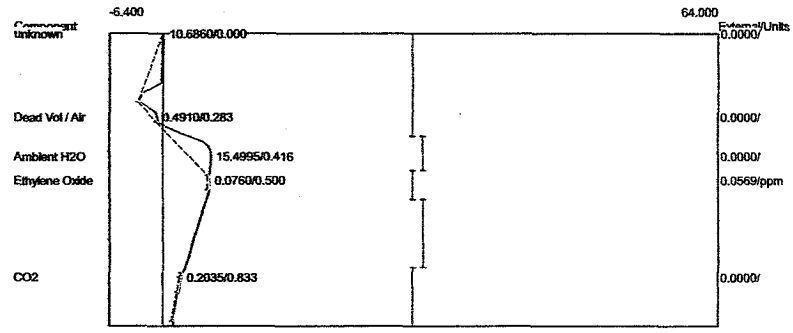
Component	Retention	Area	External	Units
Ambient H2O	0.400	169.5280	0.0000	
		169.5280	0.0000	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:25:06
Method: Direct Injection
Description: CHANNEL 1 - FID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto1-100.cpt
Data file: 1SterAtl-2016-3B12.CHR (c:\peak359)
Sample: AAT Inlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.233	1.8980	0.0000	
Ethylene Oxide	0.550	18.9390	94.3646	ppm
		20.8370	94.3646	

Lab name: ECSI
Client: Sterigenics - Atlanta
Client ID: Run#3BV
Analysis date: 03/17/2016 23:25:06
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterAtl-2016-3B12.CHR (c:\peak359)
Sample: AAT Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.283	0.4910	0.0000	
Ambient H2O	0.416	15.4995	0.0000	
Ethylene Oxide	0.500	0.0760	0.0569	ppm
CO2	0.833	0.2035	0.0000	
		16.2700	0.0569	

APPENDIX E

Field Data and Calculation Worksheets

ECSi, Inc.

Ethylene Oxide Mass Emissions Data and Calculations - Backvent

Sterigenics, Inc. - Atlanta, Georgia - March 17, 2016
AAT Safe Cell System

DeltaP	SqRtDeltaP	Temp (F)	ppm EtO
	Run #1		
0.37	0.6083	89	0.01
0.37	0.6083	89	3.11
0.37	0.6083	88	1.81
0.37	0.6083	88	1.40
0.37	0.6083	88	0.56
0.37	0.6083	88	0.43
0.37	0.6083	88	0.01
0.37	0.6083	88	0.01
0.37	0.6083	88	0.01
0.37	0.6083	88	0.01
0.37	0.6083	88	0.01
	Run #2		
0.37	0.6083	88	0.36
0.37	0.6083	88	1.14
0.37	0.6083	88	0.74
0.37	0.6083	88	0.60
0.37	0.6083	88	0.64
0.37	0.6083	87	0.01
0.37	0.6083	87	0.01
0.37	0.6083	87	0.01
0.37	0.6083	87	0.13
0.37	0.6083	87	0.01
0.37	0.6083	87	0.01
0.37	0.6083	87	0.01
	Run #3		
0.37	0.6083	87	0.80
0.37	0.6083	87	0.91
0.37	0.6083	87	0.12
0.37	0.6083	87	0.01
0.37	0.6083	87	0.01
0.37	0.6083	87	0.01
0.37	0.6083	87	0.01
0.37	0.6083	87	0.28
0.37	0.6083	87	0.01
0.37	0.6083	87	0.01
0.37	0.6083	87	0.01
0.37	0.6083	87	0.06
Average =			
0.37	0.6083	87.5	**0.3794**
		= 548	degR

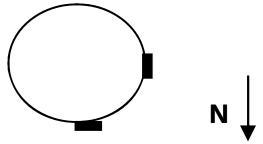
stack ID =	28	in.
stack area =	4.276	sq. in.
press =	29.05	in. Hg
Tstd =	528	deg R
Pstd =	29.92	in Hg
Cp =	0.99	
Kp =	85.49	
Velocity =	41.9	ft/sec
Flow =	**9854**	**dscfm**
MWeto =	44.05	
MolVol =	385.32	
ppmv/ft3 =	1000000	
EtO Mass Flow =	**0.000427**	**lbs/min**
EtO Mass Flow =	**0.025646**	**lbs/hr**

ECSI, INC. - VELOCITY TRAVERSE DATA

Client: Sterigenics, Inc. Run #: 1 Date: 3/17/2016 Port Sketch:

Location: Atlanta, Georgia Probe Type: Std. Baro Press: 29.05

Source: AAT Safe Cell System Outlet Stack I.D.: 28 in. DSCFM: **9840**



	Port 1							Port 2						
Inches From Port	Point#	Delta P Low	Delta P High	Delta P Average	Delta P Sq Root	Stack Temp (F)	Cyclonic Angle	Point#	Delta P Low	Delta P High	Delta P Average	Delta P Sq Root	Stack Temp (F)	Cyclonic Angle
0.6	1	0.35	0.35	0.35	0.5916	88	0	1	0.35	0.35	0.35	0.5916	88	0
1.8	2	0.36	0.36	0.36	0.6000	88	0	2	0.35	0.36	0.355	0.5958	88	0
3.2	3	0.36	0.37	0.365	0.6042	88	0	3	0.36	0.36	0.36	0.6000	88	0
5.0	4	0.37	0.37	0.37	0.6083	88	0	4	0.37	0.37	0.37	0.6083	88	0
7.0	5	0.38	0.38	0.38	0.6164	88	0	5	0.37	0.38	0.375	0.6124	89	0
10.0	6	0.39	0.39	0.39	0.6245	88	0	6	0.38	0.39	0.385	0.6205	89	0
18.0	7	0.39	0.39	0.39	0.6245	88	0	7	0.39	0.39	0.39	0.6245	89	0
21.0	8	0.38	0.39	0.385	0.6205	89	0	8	0.38	0.39	0.385	0.6205	89	0
23.0	9	0.37	0.38	0.375	0.6124	89	0	9	0.37	0.38	0.375	0.6124	89	0
24.8	10	0.36	0.37	0.365	0.6042	89	0	10	0.37	0.37	0.37	0.6083	90	0
26.2	11	0.36	0.36	0.36	0.6000	89	0	11	0.36	0.37	0.365	0.6042	90	0
28.4	12	0.35	0.35	0.35	0.5916	90	0	12	0.36	0.36	0.36	0.6000	90	0
	13							13						
	14							14						
	15							15						
	16							16						
	17							17						
	18							18						
	19							19						
	20							20						
	21							21						
	22							22						
	23							23						
	24							24						
									Average Values:		0.3700	0.6082	88.7	0.0

ETHYLENE OXIDE SOURCE TEST/CALIBRATION DATA

Client: Steriagenics - Atlanta

Source Tested: Ceitcote Scrubber / AAT Safe Cell System Date: 3/17/16 3/18/16

PRE CALIBRATION

	Calibration Gas Conc. (ppmv)	1.10 ppm EtO	10.1 ppm EtO	100 ppm EtO	1000 ppm EtO	10080 ppm EtO			
Inlet (FID)	Area Counts #1	.23	1.99	19.1					
	Area Counts #2	.22	2.02	19.6					
	Average Area	.23	2.01	19.4					
	Audit Standard (48.8 ppmv) Result					498 ✓			
Outlet (PID)	Calibration Gas Conc. (ppmv)	1.10 ppm EtO	10.1 ppm EtO	100 ppm EtO					
	Area Counts #1	1.54	13.1	126					
	Area Counts #2	1.57	13.4	128					
	Average Area	1.56	13.3	127					
	Audit Standard (48.8 ppmv) Result					485 ✓			

	Ch. 3	Ch. 8	Ch. 11
Exhaust	Run #1	Run #2	Run #3
Backvent Start:	1739	1118	1203
Stop:	1803	1140	1223
Backvent Start:	2229	2253	2310
Stop:	2335	2308	2325
	Ch. 11	Ch. 10	Ch. 7

P_{bar}: 29.05

$\%H_2O$: 3

EtO Usage (lbs/yr): —

Cycles Per Week: —

POST CALIBRATION

	Calibration Gas Conc. (ppmv)	1.10 ppm EtO	10.1 ppm EtO	100 ppm EtO	1000 ppm EtO	10080 ppm EtO			
Inlet (FID)	Area Counts #1								
	Area Counts #2								
	Average Area								
	Audit Standard (48.8 ppmv) Result								
Outlet (PID)	Calibration Gas Conc. (ppmv)	1.10 ppm EtO	10.1 ppm EtO	100 ppm EtO					
	Area Counts #1								
	Area Counts #2								
	Average Area								
	Audit Standard (48.8 ppmv) Result								

ECSi

APPENDIX F

Gas Certifications

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Scott Specialty Gases
2600 CAJON BLVD., SAN BERNARDINO, CA 92411 Phone: 909-887-2571 Fax: 909-887 0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Project No.: 02-57164-001
Item No.: 02020001310TCL
P.O. No.: VBL – D KREMER

Cylinder Number: CAL4448
Cylinder Size: CL
Certification Date: 14Apr2014

Customer

ECSI, INC
PO BOX 848
SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
ETHYLENE OXIDE	1.10	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: MT DATE: 4-14-14

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Scott Specialty Gases
2800 CAJON BLVD., SAN BERNARDINO, CA 92411 Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Project No.: 02-57164-003
Item No.: 02020001320TCL
P.O. No.: V9L – D. KREMER

Cylinder Number: CLM003232
Cylinder Size: CL
Certification Date: 14Apr2014

Customer

ECSI, INC
PO BOX 848
SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
ETHYLENE OXIDE	10.1	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: MT DATE: 4-14-14

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Scott Specialty Gases
2800 CAJON BLVD., SAN BERNARDINO, CA 92411 Phone: 909-887-2571 Fax: 909 887 0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Project No.: 02-57164-004
Item No.: 02020001330TCL
P.O. No.: VBL – D. KREMER

Cylinder Number: CLM011385
Cylinder Size: CL
Certification Date: 14Apr2014

Customer

ECSI, INC
PO BOX 848
SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
ETHYLENE OXIDE	100.	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: B. McCully BLM DATE: 4-14-14

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Scott Specialty Gases
2600 CAJON BLVD., SAN BERNARDINO, CA 92411 Phone: 909 887 2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Project No.: 02-57164-005
Item No.: 020200013401CL
P.O. No.: VBL – D. KREMER

Cylinder Number: CLM002810
Cylinder Size: CL
Certification Date: 14Apr2014

Customer

ECSI, INC
PO BOX 848
SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
ETHYLENE OXIDE	1.000.	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: _____ BLM DATE: 4-14-14

CERTIFIED WORKING CLASS

Single-Certified Calibration Standard

Scott Specialty Gases
2600 CAJON BLVD., SAN BERNARDINO, CA 92411 Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information
Project No.: 02-57164-006
Item No.: 020200013407CL
P.O. No.: VBL – D. KREMER

Cylinder Number: CLM005787
Cylinder Size: CL
Certification Date: 14Apr2014

Customer

ECSI, INC
PO BOX 848
SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
ETHYLENE OXIDE	10,080.	PPM	5
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: B. McCully BLM DATE: 4-14-14

MESA

CERTIFICATE OF ANALYSIS

Customer Name:	ECSi, Inc.	**Cylinder Number:**	SA25925
Stock or Analyzer Tag Number:	N/A	**Product Class:**	Certified Standard
Customer Reference:	Verbal- Dan	**Cylinder - Contents[1]:**	28 CF @ 2000 PSI
MESA Reference:	104448	**Cylinder-CGA:**	A006-HP-BR 350
Date of Certification:	4/15/2014	**Analysis Method:**	GC-ECD/FID
Recommended Shelf Life:	2 Years	**Preparation Method:**	Gravimetric

Component	Requested Concentration[2]	Reported Concentration[2,3]
Ethylene Oxide	50 ppm	48.8 ppm
Nitrogen	Balance	Balance

Authorized Signature:

1. The fill pressure shown on the COA is as originally quoted. The fill pressure measured by the customer may differ from the fill pressure originally quoted due to temperature effects, compressibility of the individual components when blended together in the cylinder, gauge accuracy or reduction in content volume before shipping as a result of samples withdrawn for laboratory QC necessary to ensure product quality.
2. Unless otherwise stated, concentrations are given in molar units.
3. Vapor pressure mixes are blended at a sufficiently low pressure so as to eliminate phase separation under most low temperature conditions encountered during transport or storage. However, it is generally recommended that cylinders containing vapor pressure restricted mixes be placed on the floor in a horizontal position and rolled back and forth to improve homogeneity of the gas phase mixture before being put into service.

Analytical Gas Standards are prepared and analyzed using combinations of NIST traceable weights, SRM's provided by NIST, or internal gas standards that have been verified for accuracy using procedures published by the US EPA. Pure gases are analyzed and certified for purity using minor component Analytical Gas Standards prepared according to the methods specified above. Balances are calibrated to NIST test weights covered by NIST test number 822/256178-06. Reference Certification #'s 1653W, 8301N and 5500. Calibration methods are in conformance with MIL-STD 45662A.

MESA Specialty Gases & Equipment
division of MESA International Technologies, Inc.
3619 Pendleton Avenue, Suite C ♦ Santa Ana, California 92704 ♦ USA
TEL: 714-434-7102 ♦ FAX: 714-434-8006 ♦ E-mail: mail@mesagas.com
On-line Catalog at: www.mesagas.com

APPENDIX G

Parametric Monitoring Data

Sterigenics

Ceilcote Readings:

T2 = 186 – Inches
PH = 1.2
Glycol = 36.3%

AAT Readings:

T2 = 105 – Inches
PH= 0.9
Glycol = 36.8%

Recorded By: _____ Date: 18-MAR-16